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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING JANUARY 21, 1997 VOL. 16 NO. 2

PC MAGAZINE

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Taking It with You

What kind of machine do you want to take with you? That question is likely to become more complicated as a new kind of lightweight personal computer enters the market this year. For those of us who carry portable computers everywhere, the smaller, lightweight devices—what used to be called personal digital assistants (PDAs) back in the days when Apple's Newton was causing a lot of hype—were a source of envy. But those devices serve very different purposes and offer significantly less functionality. It all comes down to what you're willing to carry and what you plan to do with it.

As a frequent traveler and a commuter, I know notebook computers inside and out. I spend more time working on my notebook than I do on my desktop PC. I view notebook computers as portable offices that offer all the functionality that I expect from personal computers. They are an indispensable part of my work. That's why I want as much power in my notebook computer as in my desktop machine—or even more. In fact, the only reason I have more power on my desktop is because it's more difficult to build smaller hardware with low power consumption. But the need for more portable power is there.

Likewise, I'm convinced that there's some need for very small, limited-function machines that hold your appointments, your schedule, and brief notes. Examples include U.S. Robotics' Pilot or the smaller organizers from Canon, Sharp, and TI. All of these have their places. Their light weight and long battery life allow them to be of use in situations where no laptop is.

I use a Pilot, and it is nice to have a tiny schedule and address book to carry around. In at least one way, it's more convenient than a paper organizer: You can sort and search. In some other ways, it's not (paper organizers never need new batteries). All in all, it's a good way to view information that you enter on another machine. Still, I don't really find it very convenient for entering notes, and certainly I wouldn't take it on a trip instead of my notebook. It's just too limited.

So there ought to be room for something in between, and that's where the traditional position has been for PDAs. They got a bad reputation, in part because people had too high expectations for them. Now, however, they appear to be undergoing a renaissance under a newer, more "correct" category heading: the handheld PC (HPC).

Whatever you call it, the new category incorporates some very interesting hardware. In addition to the first generation of machines running the Windows CE operating system (see First Looks, page 45), this category includes the Psion organizers, the new, much-improved Newton, and the higher-end traditional organizers, like the Sharp Zaurus. These machines are incredibly powerful for their relatively small size, and they certainly do a lot more than the pocket-size organizers. And yet, when it finally comes down to carrying them, I'm still far from convinced. If I have any real data to enter, these simply aren't the machines I want to be typing on. They tend to be too big to keep in your pocket, yet not functional enough to take the place of a laptop.

Most of the hardware limitations can be corrected fairly easily over time. We'll get better screens, more storage, and better batteries. But what we really need is the right software. For me to adopt one of these machines, I must get an intelligent e-mail client. I want a device that supports all the major e-mail packages, including cc:Mail, Microsoft Mail, Notes, Exchange, Groupwise, and Internet mail. We are beginning to see some limited e-mail functionality and even Web browsing, but thus far most of these are designed for connected use only. I want a device that understands the importance of off-line reading and the limitations of a machine with a small display.

The new HPCs give me hope that such a machine can exist. It still won't replace my laptop, because I can't imagine wanting to do any real typing on any keyboard that would fit on a pocket-size device. But when I'm out of the office for a quick meeting or even on a day trip, one of these devices may well suffice.

Michael J. Miller

MICHAEL J. MILLER

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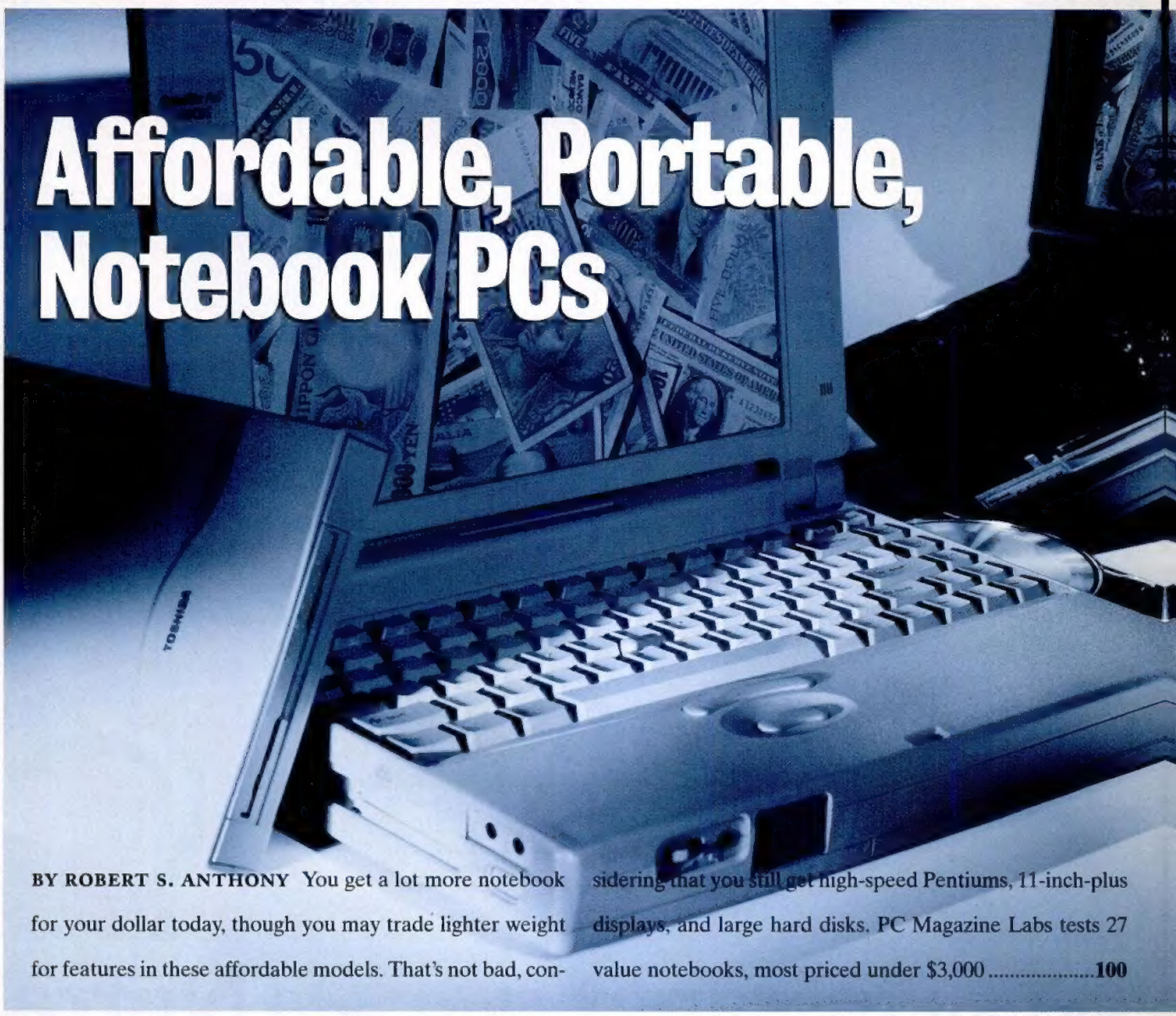
January 21, 1997
Volume 16
Number 2

COVER STORY



Affordable, Portable, Notebook PCs

BY ROBERT S. ANTHONY You get a lot more notebook for your dollar today, though you may trade lighter weight for features in these affordable models. That's not bad, considering that you still get high-speed Pentiums, 11-inch-plus displays, and large hard disks. PC Magazine Labs tests 27 value notebooks, most priced under $3,000 ..... **100**

ONLINE

What's New Online

The New Notebooks

Join us at *www.pcmag.com* for access to interactive benchmark test results and summaries of features for the notebook PCs evaluated in this issue. Also on the Web: the product of the week, the site of the week, and new InternetUser reviews.

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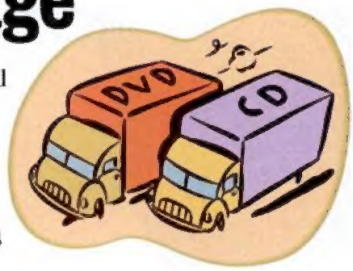
DVD AND CD-ROMs

21st-Century Storage

BY ALFRED POOR AND JAMES KARNEY

The future of storage is here: DVD disks hold 4.7GB of data and will slowly replace CD-ROM in the PC arena and laserdisks for home entertainment systems. Eventually, rewritable DVD will open up even more possibilities. But CD-ROM will be a viable, cost-effective option for some time to come. We test the latest generation of high-speed 10X and 12X drives ...**164**



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PERSONAL FINANCE SOFTWARE

Making Your Money Make Money

BY KATHY YAKAL

It's not as bad as you think. This year's crop adds some great new features, like debt- and tax-reduction aids to make financial management more useful. In this group, you'll find more electronic banking options, a major face-lift for an old favorite, and a new face in the crowd. Connections to the Internet are better, too. If you're just jumping in, now's a good time to start **295**

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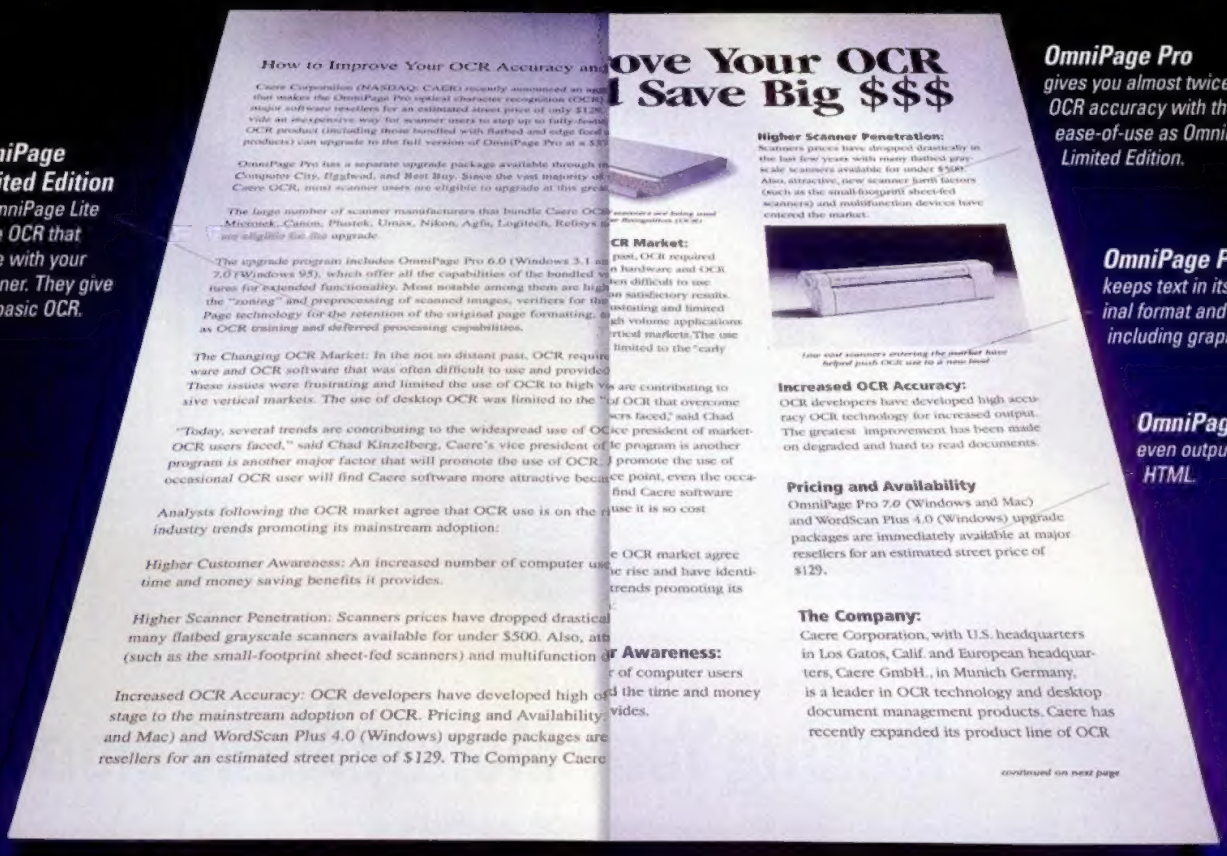

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Pipeline

The Next Easy Interface

Remember Bob? Microsoft's attempt at a natural, personal PC interface wasn't exactly a barnstorming success, but Microsoft hasn't given up on designing natural interfaces. Engineers at the company's R & D lab are experimenting with some far-out technologies designed to make the PC more approachable. "Ninety percent of the code in tomorrow's operating system will be dedicated to these new input and interface technologies," says Microsoft CEO Bill Gates. That vision doesn't just differ from Microsoft's competitors' push for the thin client—it practically defies it.

The prototypes in the R & D lab use video cameras to interpret gestures and Microsoft's Whisper voice recognition technology to carry out spoken commands. One particularly tough problem researchers are trying to solve centers on natural-language processing that puts speech into context, and not on the actual speech recognition engine itself.

Microsoft is also working on "collaborative filtering" for Internet applications using agents. A prototype application resembles a Web search engine but is designed to match your preferences to usage patterns collated from many other Web users. Using this information, the application could make intelligent recommendations on which Web content might interest you, even though you didn't ask for it specifically. This approach correlates with Gates's notion that "the PC of the future won't just serve up a huge group of folders all at once, but will deliver important content first, with less important content hierarchically lower."

Although many of these technologies have been seen before, there's no mistaking how broadly Gates sees them changing the PC platform. He predicts that voice recognition, natural language processing, gesture interpretation, and natural interfaces will all take off within the next decade.

ILLUSTRATION BY MARC COHEN

"There's no such thing as 100-percent effective copy-protection technology."

Alan Bell, *storage expert at IBM's Almaden Research Center and chairman on the DVD working group on copyrights, on the difficulty of preventing the piracy of movies and software from DVD disks.*

Cheap Tix

Rock group Pearl Jam recently took a stand against high-priced tickets when it refused to let TicketMaster sell tickets to its shows. Others are taking action too. TicketWeb (*www.ticketweb.com*)—the Web's first Internet-only ticketing service—can save you some bucks. You can buy tickets for a host of mostly alternative-focused venues and attractions in the San Francisco Bay Area, Seattle, Florida, Maryland, and Oregon. TicketWeb charges a 50-cent service charge plus 5 percent of the cost of the ticket, with caps of $1 if you pay via the Web and $1.75 if you pay by mail. So a $10 ticket incurs a charge of $1, a far cry from TicketMaster's "convenience" fee of $2.50 to $10. TicketWeb plans to expand into New York City, Los Angeles, Chicago, Canada, and Europe this year.

IN CONCERT: *TicketWeb features angry singer Alanis Morisette.*

A Penny Saved...

According to Netscape CEO Jim Barksdale, the Web's money-making potential will come not from electronic commerce but from the cost savings of Web-based intranets. According to a study by market-research firm IDC, consulting company Booz Allen & Hamilton's Netscape On-Track intranet has produced a 1,389-percent return on investment in two months.

Meanwhile, bracing for a scuffle with Lotus Development, Netscape is working on an e-mail–centric groupware product called Communicator. A module called Constellation will receive "Webcast" newsfeeds from companies such as PointCast and Marimba.

Online: The Spinners

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CD-ROM, we hardly knew ye. As the new year begins, so does the speculation that DVD technology is poised to trample the good old CD-ROM. Join us online to participate in a discussion centered on this issue's coverage of CD-ROM and DVD drives, and decide for yourself. Is it time to start saving for an upgrade?

NOTEBOOK HEAVEN. Is this the year you treat yourself to a new notebook? Our exclusive interactive benchmark test and price/performance viewers and our interactive summary of features will let you sort the results for all the systems evaluated in this issue's notebook PC story by whichever criteria interest you the most.

ALSO ON THE WEB. Stop by every day at our NewsWatch page to read up on our latest Trends articles and news analyses. And don't forget to check out the daily News.Scan summary of computer news from the mainstream press and an up-to-the-minute feed from the ZD Net News Wire.

Pipeline

Cheaper Chips and More Eyeballs

As the cost of building a microprocessor factory—known as a "fab"—rises astronomically, Intel is facing an astronomical challenge. Consider this: Intel built its first fab in 1973 for $3 million, including factory and equipment. Intel's latest factory cost a cool $2.5 billion. Intel CEO Andy Grove projects that, based on current trends, chip factories will cost a whopping $10 billion by the year 2000. "Is a factory like this economical?," he asks. That depends on how much you put in it. "An empty factory that costs that much is deadly," he says, "but one pumping out products can be economical."

Solving the economic challenge at the factory—a capital expense that amortizes over large volumes—could come from a cultural shift. "The next challenge is to grow the number of computer users," Groves says. "Simply put, we are in a war for consumers' eyeballs. Consumers have a choice of watching TV or interacting with PCs." What Grove is really after is the number of leisure hours you spend on your computer instead of in front of your television. First order of business, he says, is for the PC to match what the TV can do.

Copyright Confab

Hollywood movie studios and software developers have finally agreed on a method for preventing the wholesale pirating of movies and applications from the new 17GB DVD (digital versatile disk) format. Or have they? Expected last year, the launch of DVD players and titles was held up by an argument over copyright protection. In late October, the Hollywood contingent agreed on a 40-bit encryption method, enabling DVD manufacturers to release players with descrambling chips based on that method. But like all technologies, it may ultimately be upgraded.

Another approach, "embedded data," hides an electronic watermark on the disk and serves as a form of self-description rather than self-protection (the way encryption does). Using this data-hiding technique, content owners can embed copyright restrictions into the disk. The recording device can then detect the copyright-control information and produce either legal copies or no copies at all, in which case a message could suggest that the user contact the copyright owner for permission. "Embedded data still needs to be developed, but it's an important part of the long-term solution," explains Alan Bell, a storage technology expert at IBM's Almaden Research Center and chairman of the DVD committee charged with solving the copyright confab. Bell also points out that copy protection rests not only on technology but on economics—whether pirates have a financial incentive to break the law—and on legislation. And since encryption methods are subject to export restrictions—an issue that has been fraught with conflict—the whole issue gets tossed into the international arena.

ILLUSTRATION BY NICK DEWAR

THIS ISSUE'S CONTRIBUTORS: *Angela Hickman, Regina Kwon, Carol Levin, Sebastian Rupley, and Don Willmott.*

For Small-Biz Owners Only

Computers on every corporate desktop and in every home, all running Microsoft software. That's been Microsoft's mission statement for years, and now you can add small businesses to the mix as well. The software giant's newly created Small Business Technology Partnership board has brought together 15 small business leaders and three Microsoft executives to plot ways to spread technology into more small American businesses—and probably to sell a little Microsoft software while they're at it.

Working under the assumption that the Internet is very much on the minds of small businesses, Microsoft has also committed $5 million in cash and software to a Small Business Online effort that's designed to help community and professional associations build Web presences and receive syndicated information feeds specific to their areas of interest. Microsoft is providing information about its small business initiatives at *www.microsoft.com/smallbiz/.*

Feed Your E-Mail Addiction

You come home after a long day at work, walk over to the phone, and find your message light blinking. You hit a button, and within seconds you start reading your e-mail. E-mail? Uniden's (*www.uniden.com*) new Axis telephone doubles as an e-mail receiver, letting you keep up with all your incoming mail.

The $399 cordless phone (a corded model costs $299) features a 6-inch backlit LCD screen and a small keyboard that's unsuitable for lots of typing but good enough for quick responses to messages. You set up the phone to go out and retrieve e-mail at regular intervals. Currently, no traditional audio answering machine is built into the phone, but Uniden plans to add one in the future. In the meantime, the phone is best suited for the truly e-mail–addicted.

Top Retail PC CD-ROMs

1. **Microsoft Windows 95 Upgrade** Microsoft
2. **Quicken Deluxe** Intuit
3. **MechWarrior 2** Activision
4. **The Print Shop Deluxe CD Ensemble III** Broderbund
5. **Warcraft II: The Tides of Darkness** Blizzard Entertainment
6. **Microsoft Publisher** Microsoft
7. **Duke Nukem 3D** Formgen
8. **Quicken** Intuit
9. **F-22 Lightning 2** Nova Logic
10. **Madden NFL 97** Electronic Arts

*Source: PC Data. Data for October 1996.

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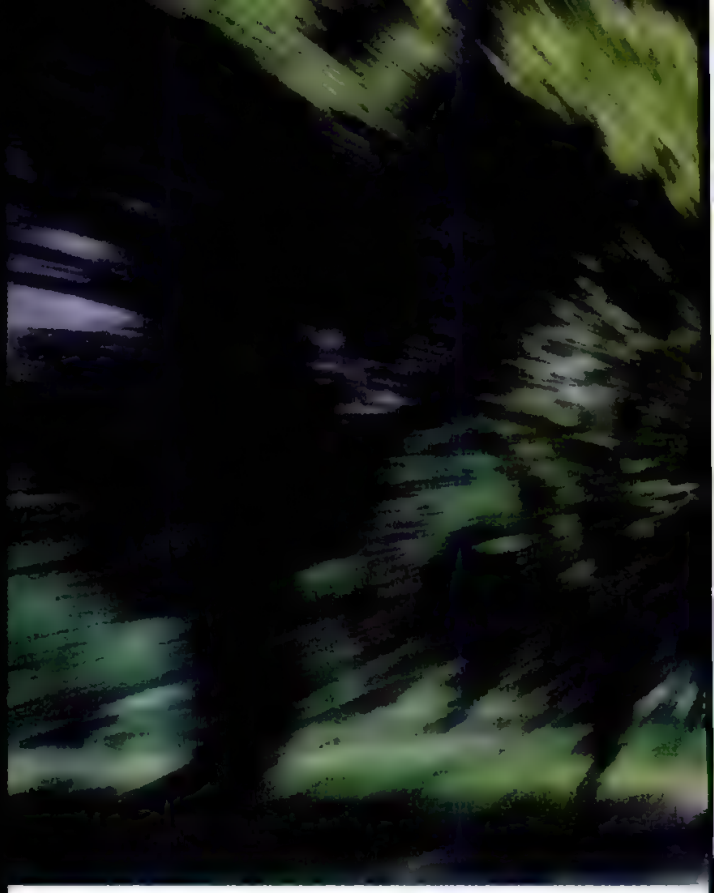

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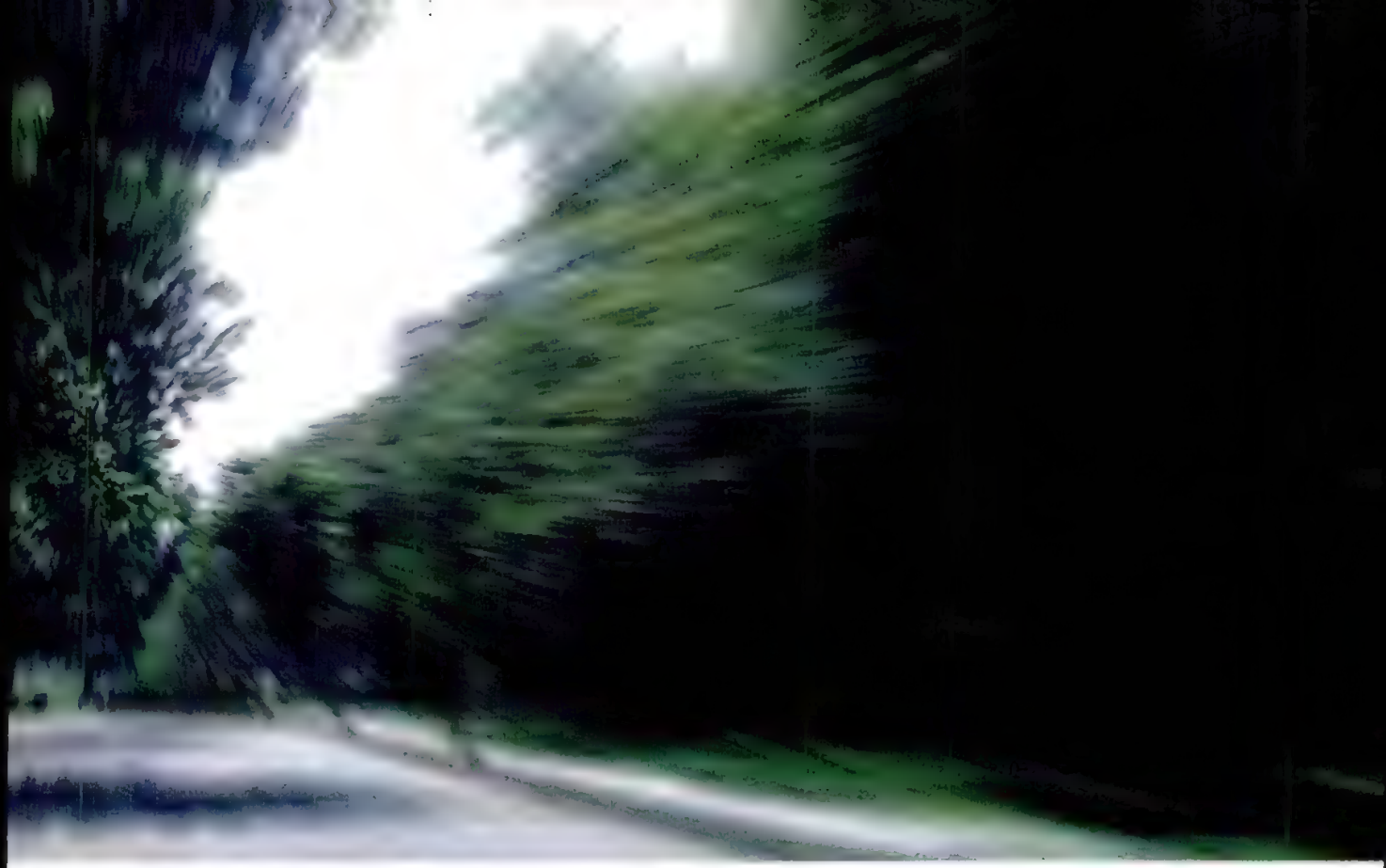

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- 1.3GB removable hard drive
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- 2.1GB removable hard drive
- Motorola Montana 33.6 fax/modem

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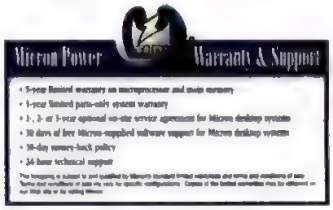
Business lease $150/month



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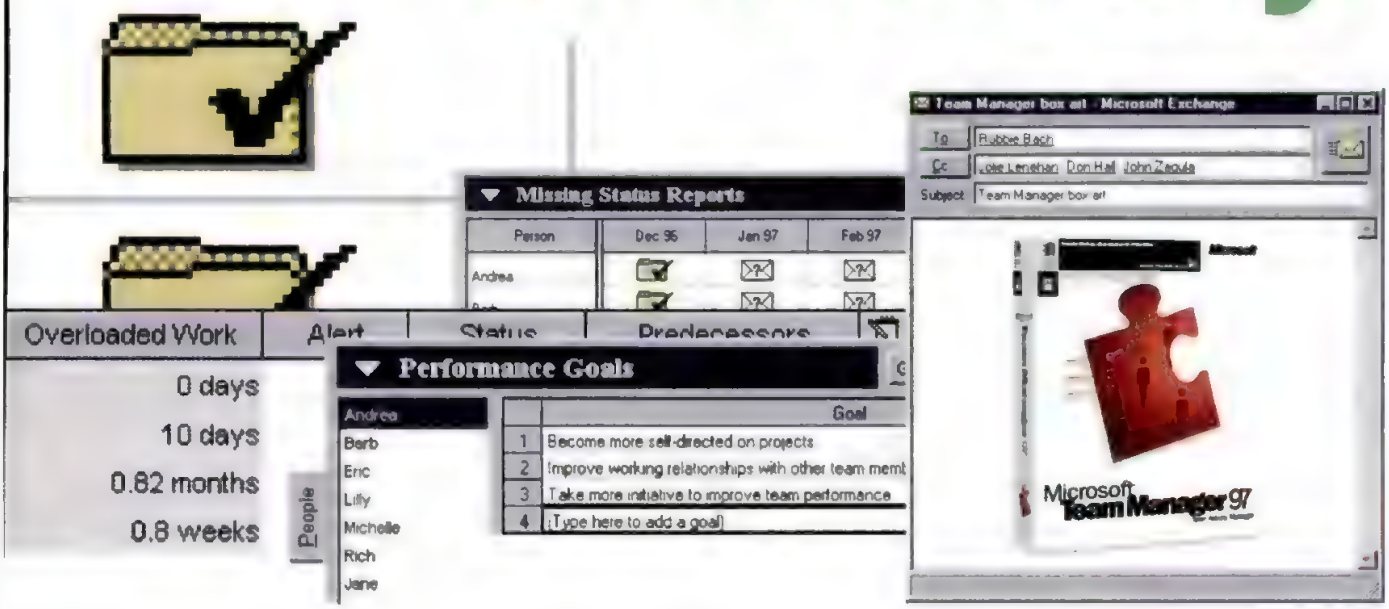

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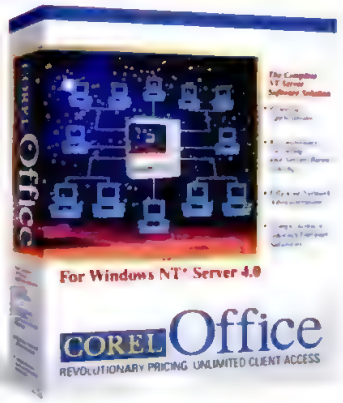

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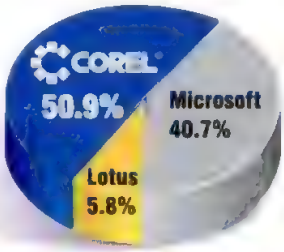

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Letters

OF PRINTERS AND PEOPLE

Your printer roundup "Personal Printers Showdown" (November 5, 1996) was precisely the sort of story I've learned to expect from *PC Magazine*. It was thorough, well documented, and impartial. But it didn't answer some major questions I have regarding the paper-handling ability and path reliability of laser printers. This is not a trivial issue for people who frequently produce professional-looking reports; it is particularly important for those of us who can't afford to waste half the paper we print on.

GEOFFREY KIDD
via the Internet

I was surprised to see you compare such a wide variety of printers in one group. It really got to me that ink jet resolutions ranged from 300 by 600 dots per inch all the way up to 1,200 by 600 dpi. How am I supposed to make a good decision without an apples-to-apples comparison?

ROBERT W. FRYE
via the Internet

What happened to dot matrix printers? They may not be fancy, print color, or even produce graphics, but they are often the workhorses in many business applications. Try feeding a four-part form through a laser printer!

GARTH FRADETTE
Radville, Saskatchewan, Canada

Your comparison of printers was useful and comprehensive. Unfortunately, you missed an important point: Many readers like me are interested only in getting ink on paper easily, inexpensively, and quickly. Many of the bells and whistles (including color) are of no interest whatsoever. I run a small business where we have recently junked most of our old reliable, noisy dot matrix printers and replaced them with Canon Bubble Jets. The Canons are lousy color printers and they're slow, but they make great black-and-white printers for average office use.

DONALD VICTORSON
Smithtown, New York

I own a Brother MFC 4550 and agree that it's an outstanding product. However, when printing off the Internet, it frequently returns a signal to the system that causes your modem to drop you off-line.

RON BUIE
Ketchikan, Alaska

I loved your printer roundup but have one complaint: You didn't cover each product's manual or help system. Documentation is a very important part of a product and can

Many of us are interested only in getting ink on paper easily, inexpensively, and quickly.

make the difference between a good product and a great product.

SHARON BURTON
via the Internet

Glancing at the test results in your recent printer story, I was struck by the fact that the print timings bore little relation to each unit's advertised print speed. It turns out that both the 4- and 6-page-per-minute printers average about 1.15 ppm across your tests, and the 8-ppm printers only a little better at 1.25 ppm. Your test methods may have been a tad on the stringent side, but overall they seemed representative of the real world.

BOB BRUSS
via the Internet

Your printer roundup's Editors' Choice recipients come from two manufacturers that received grades of D in the Service and Reliability story in the same issue. You take your Service and Reliability survey results seriously when selecting Editors' Choices for PCs; why not for printers as well?

TOM CAVANAUGH
Upper Marlboro, Maryland

HONORABLE MENTIONS

I was disappointed to find Realsoft's Real 3D missing from your lineup of top 3-D animation software ("Ideas Taking Shape," November 5, 1996). Real 3D is often overlooked but has some of the most advanced 3-D tools available for the PC.

HOWARD P. SMITH
via the Internet

It's nice to read an exploration of the pros and cons of the different 3-D packages available today. I use a few of them on a daily basis: 3D Studio Max, Softimage, and Lightwave3D. I also use Realsoft's Real 3D and find it to have most of the features of the other packages, as well as features not found or poorly implemented in its peers.

CHRISTOPHER JANNEY
via the Internet

TABLE FOR 200?

Your application server roundup ("The Power of Four," October 22, 1996) was one of the most peculiar stories ever published in *PC Magazine*. These systems are capable of handling probably hundreds of users, and yet none of them would be particularly economical. No company that could use such a server as you reviewed would put 200 users on one machine, because if the server goes down then the company goes down with it. A more practical configuration would be to take the approximately $30,000 price tag and spend it on three or more servers with half the punch or less. That way, the whole company isn't out of business if one of these servers goes down.

GLENN BILY
via the Internet

As I read your piece on application servers, I was struck by the herd mentality and limited imagination of the vendors represented. Although there were differences in performance, fault tolerance, and so on, not one company broke rank and offered something really new. Would it be too radical to expect a vendor to integrate a LAN hub? I thought it was ironic that vendors offered network management software without the network.

RAJENDRA SUPNEKAR
Tinton Falls, New Jersey

Regarding the sidebar entitled "Sharing the Wealth Today Clears Path for the Future" (page 207) in your application server feature, I was amazed to see no mention of Novell's implementation of fault tolerance (SFT III). This is a very real solution for server hardware fault tolerance that has been out for years.

JEFF ZINKERMAN
Greenwich, Connecticut

BULL'S-EYE

I have to express my pleasure with your utility Explorer Notes (Utilities, November 5, 1996). It was right on the mark for file management. Microsoft should be chastised for not making this an inherent part of Explorer. The usefulness of Explorer Notes is exactly what I expected (but found missing) from Windows 95's long-name file ability

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Large 11.3" active-matrix diagonal color screen with 800 x 600 resolution

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Speedy 32-bit PCI bus for faster system throughput

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Operating system is Windows® 95/Windows for Workgroups dual install

PCWEEKLABS ANALYST'S CHOICE JUNE 3, 1996

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ExpressONE™ (Overnight Notebook Exchange) is an optional, next business day, on-site notebook replacement program with FedEx®, only available from AST

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Warranty: For the first year, ExeCare Plus℠ 48-hour Repair. For years two and three, Worldwide Carry-in Service

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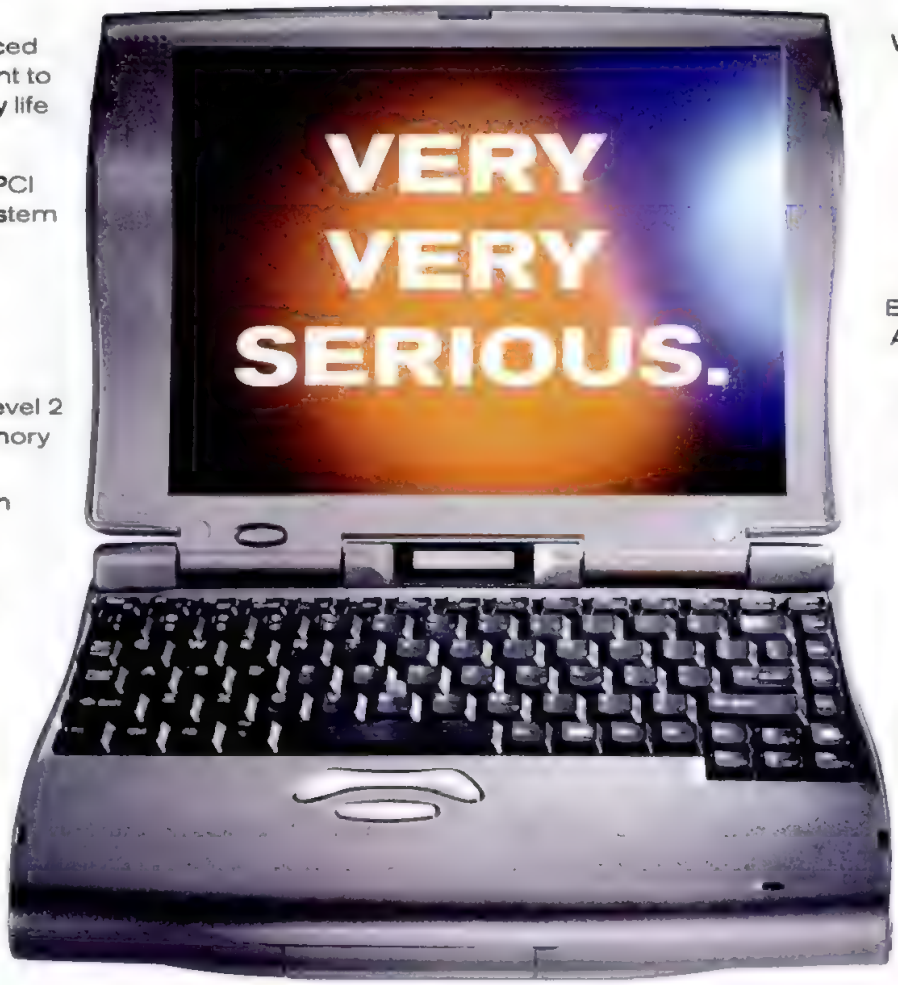

PC MAGAZINE EDITORS' CHOICE

PC Magazine
Editors' Choice Award, August 1996 for the Ascentia J50

16 MB RAM standard, expandable to 40 MB

SmartPoint™ Trackstick for easy, fingertip control of your work

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ASCENTIA™ J55:
Powerful 133 MHz Pentium® processor

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Infoworld
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Huge 12.1" active-matrix diagonal screen with 800 x 600 resolution

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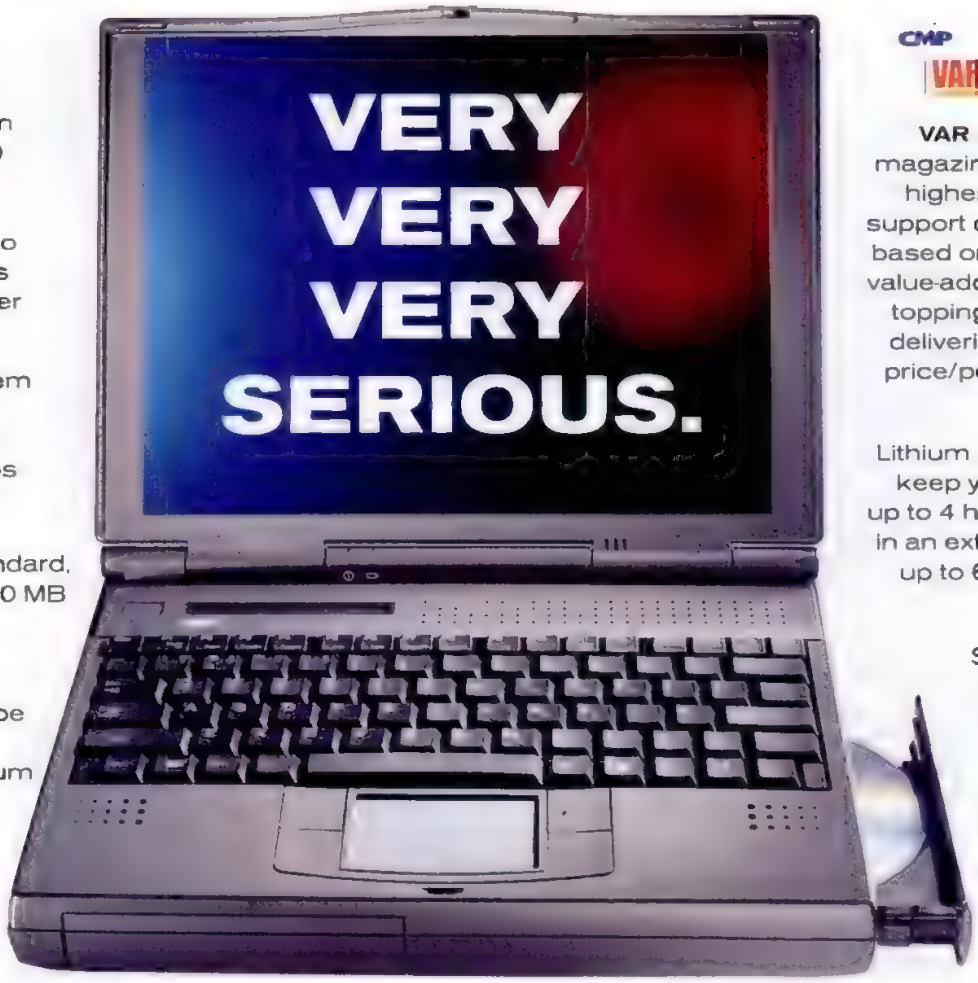

CMP
VARBusiness
July 1996

VAR Business magazine rated AST highest for tech support of notebooks based on a survey of value-added resellers, topping the list for delivering the best price/performance

Lithium Ion battery to keep you working up to 4 hours, or swap in an extra battery for up to 6 1/2 hours

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when I upgraded. Explorer Notes is such an excellent idea, I would like to see upgrades to it.

GREG SADDLER
via the Internet

COLOR ME HAPPY

In your story about color laser printers ("A Spectrum of Choices," October 22, 1996), you neglected to mention output glossiness. Though you can't put a quantitative measure on it, glossiness can be a serious detraction. It might be okay for photos but is frowned on in presentations and reports.

RUSSELL SCHWAGER
via the Internet

Your piece on color printers provided the information I need to make an informed decision in buying a printer for my software business.

JANISS H. GRAVES
via the Internet

BETTER BANKING

I enjoyed Bill Howard's column "PC Banking Benefits" (October 22, 1996), in which he mentions the two most popular home finance packages, Intuit's Quicken and Microsoft Money. Another option I have found even more useful is going with an online bank like Security First Network Bank (*www.sfnb.com*), which offers complete services on the Web. No proprietary software is needed, and you can download transaction information into Quicken or Money. The service is free, as are the basic checking accounts.

ED HILL
Miami, Florida

HOW TO CONTACT US

We welcome your comments and suggestions. Please send Letters to the Editor via

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All letters become the property of PC Magazine *and are subject to editing. We regret that we cannot answer letters individually. To send submissions for PC Solutions, please see the sidebar "How to Contact Us" on the last page of that column.*

CORRECTIONS AND AMPLIFICATIONS

In the New & Improved section of our September 10, 1996, issue ("Keeping Up with Technologies," page 78), we listed an incorrect toll-free number for Deloitte & Touche Consulting Group. The correct phone number is 800-887-7790. Also, the correct subscription price for the company's CD-ROM, Deloitte & Touche convergence.d&t, is $995 per year, or $295 per quarter.

In the New & Improved section of our November 5, 1996, issue ("Photo Scanners Extraordinaire," page 74), we listed incorrect prices for Polaroid Corp.'s SprintScan 35 Plus and SprintScan 35/LE. The correct prices are $2,595 and $995, respectively.

In our review of the IBM Internet Connection Service ("The Net Grows Wider," November 19, 1996, page 174), we listed an incorrect alternative monthly pricing plan. The correct pricing is $4.95 a month for 3 hours, plus $1.95 for each additional hour.

OFF THE BEATEN PATH

Regarding John C. Dvorak's column "The Computers-in-Education Fiasco" (October 8, 1996): Perhaps we computer people suffer from tunnel vision when it comes to the reasons behind the quality of education today. I'm a fairly intelligent computer professional, and I never even touched a computer until the sixth grade. I hazard to guess that computers never affected Dvorak's elementary-school education either. The turnout of America's schools has less to do with technology than with ideology. It's time for schools to focus on real school, not social reengineering at the elementary level.

RON HAMMAN
via the Internet

INSIDE NEWS

Until I read Dvorak's Inside Track of October 22, 1996, I was unaware that my six-month-old Diamond Supra FaxModem 288i PNP could be upgraded to 33.6 Kbps with a software patch. This is a shining example of the usefulness I have found in *PC Magazine*.

SHERRY CURTIS
via the Internet

Inside Track is always an interesting read, but I found Dvorak's views on the MMX delay very strange. His suggested cure of shipping "temporarily crippled machines" ignores the obvious: If consumers won't buy ordinary Pentiums because they aren't MMX-enhanced, why should they buy disabled MMX computers that they think are ordinary?

SUHAIL AKHTAR
via the Internet

VIRTUAL VIEW

Bill Machrone's column "The Sorry State of Telecommuting" (October 8, 1996) is disturbingly shortsighted. Though he claims we have made precious little progress in realizing the benefits of telecommuting (reduced stress, improved air quality, and greater productivity), we are in fact close to making telecommuting a feasible work environment, complete with the basic need that Machrone claims will always be lacking in telecommuting: human contact. Given the current pace of progress being made in increasing communications bandwidth, within a couple of years we should be able to create virtual offices in our homes—complete with collaborating coworkers.

MICHAEL D. NOAH
via the Internet

SHORTCUT TO OZ

The October 8 Tutor column "Take the Shortcut" says that "for the shortcut key to work, the shortcut itself must be located on the desktop." In fact, if the properly configured shortcut is anywhere in the Start menu (not necessarily StartUp), it will work even without its shortcut key being on the desktop. My desktop is bare, but I make extensive use of shortcut keys to activate programs.

GEORGE ADKISSON
via the Internet

DO NOT DISTURB

The article "Reaching for the Net" (October 8, 1996) was very informative. But I felt it ignored two major areas: security and connectivity, and international interoperability. In this world of information sharing, security is becoming more and more of an issue.

DOC PISAPATI
via the Internet

HAPPY TRAILS

Y'all must be flatland city folks to dump on the quality of CB radios the way you did in the First Looks article "Net2Phone Makes the Call" (October 22, 1996, page 58). Up here in the mountains of Northern California, next to a police scanner our most important electronic gadget is a CB radio. The quality of sound is clearer than that of a chainsaw a mile away, and CBs won't die in the valleys the way cell phones do. Keep up the good work testing all that new stuff we can't afford to buy, but we here in the boondocks will stick to the tried-and-true sound quality of CBs.

TODD DETZEL
Laytonville, California

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PC Magazine Labs Analyst's Choice Feb 12, 1996

PC World

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INTRODUCING A CONCEPT PREVIOUSLY OVERLOOKED IN MONITOR DESIGN.

While some monitor companies struggle to achieve a convergence of audio and video, one has patiently taken the time to engineer a truly integrated system: The media-ready series from Nokia.

The difference is obvious, yet inconspicuous. Behind the sleek tooling, await dual powered stereo high/midrange speakers and a deep-tuned omni-directional subwoofer ready to give color and space to the richest audio your computer can unleash. This builds on the expertise Nokia

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applies to designing sound systems for German luxury cars, incorporating principles of near-proximity sound delivery. As Europe's premiere monitor company, Nokia has created a tuning port architecture housed in the monitor's swivel base which allows complete utility plus maximum aural impact. What's more, these systems build on Nokia's most award-winning monitor line: the X series. Now you can gaze into some of the most exquisitely ergonomic screens in the world—including the first to meet the new VESA standards for refresh and resolution. Their aperture grill of a mere .25 presented on a spacious 15.7" viewing area make these more than just screens. They are a work environment that is simultaneously soothing and exciting.

The media-ready series are also the first systems to achieve TCO'95 standards for monitor emissions. With that, and the clutter of wires and speakers removed from the precious real estate around your computer, you will suddenly be enjoying a much nicer place to work.

If you are preparing to upgrade your monitor—or your computer's audio system—don't overlook these phenomenal displays. They offer a level of superiority you can appreciate even with your eyes closed. For more information, please visit us at **www.nokia-americas.com** or call us at:

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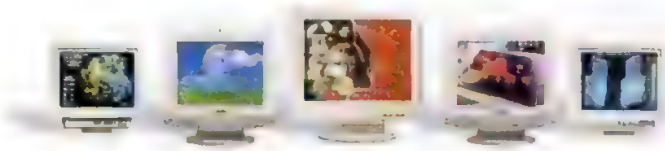
[illegible]	640×480	800×600	1024×768	1152×870	1280×1024	1600×1200
447X ov–17"	150Hz	140Hz	110Hz	100Hz	85Hz	72Hz
447X ovc–17"	150Hz	140Hz	110Hz	100Hz	85Hz	72Hz
[illegible]						
445X ov–21"	150Hz	150Hz	120Hz	110Hz	100Hz	80Hz
445X ovc–21"	150Hz	150Hz	120Hz	110Hz	100Hz	80Hz

(21" actual viewing area is 19.69")



NOKIA

Trends

ILLUSTRATION BY PETER COATES

No Starting Over

Microsoft wants more power on the desktop, not less.

Microsoft CEO Bill Gates has heard the battle cry for an alternative to the PC platform, and he shrugs it off as just another step in a long string of futile challenges to the PC's dominance.

The network computer concept championed by Oracle and Sun Microsystems is functioning as a launching pad for Gates's vigorous defense of the present and the future of the PC. During his keynote address at the Comdex computer trade show held in November, Gates focused on a bright, Internet-centric future for the PC platform, where new technologies, such as speech recognition and videoconferencing, would only make the PC more powerful.

With a base of 200 million users and a healthy growth rate of around 10 percent per year, the PC industry isn't about to throw in the towel. "The PC approach has proven to be superior," Gates said. "The industry structure has an incredible benefit: The economies of scale allow very advanced technology to move quickly into the marketplace with very little markup."

Gates emphasized that architectural challenges have come up against the PC in the past but have never prevailed. In the 1980s, for instance, Unix workstations, with their 32-bit processing and rich graphics, far outperformed the PC. Yet the industry didn't make a transition to the Unix platform. "Only in the last year can we say that we can match these systems toe-to-toe," he said. He made it clear that it wasn't until the early 1990s that the graphical interface became mainstream on the PC. Object orientation also tried to branch out on its own, with Taligent—backed by Apple, Hewlett-Packard, and others—but that effort was abandoned when the industry realized that the PC could adopt object orientation.

TCO ON TRIAL: *Total cost of ownership (TCO) is key to Sun's Scott McNealy (left), who presses for Java-centric network devices, and to Microsoft's Bill Gates, who defends the PC platform.*

"Now, there's an effort to extend the Web browser and build a new kind of computing device around it," said Gates. He described the Internet as having a huge range of devices attached to it, which would require a subset of the PC rather than the wholly new architecture of a network computer.

What does Gates think of the network computer? "It's a tricky term," he said. If it's a device without a hard disk, then Windows can play there, too. Sony, for instance, is deploying airline seat-back displays running Windows 95 from a fiber-optic connection. Gates explained that although there will be more and more applications for diskless computers, it's important to keep in mind that networks will get overloaded if you go diskless and try to run applications over a modem.

PERSONALIZED PC

Gates's future PC will have fantastic bandwidth, videoconferencing, a large screen, and voice recognition. You'll be able to move easily from desktop to notebook and replicate the state of your personalized desktop by downloading it from a network. Most important, the PC will have agent technology so that the machine can adapt to what you want to do. "All of this will be possible within the next decade," he predicted.

While the Internet is a top priority at Microsoft, making computers easier to use is right up there, too. "We still we have a long way to go on this," Gates conceded. Microsoft's upcoming Active Desktop, for instance, will display just the information you want, whether it's newsfeeds from the Web or documents from your hard disk. Gates also pointed to improvements in technical support, to the extent that the whole context of a computer problem can eventually be sent over the Internet to technicians. Microsoft is also working on the "zero administration" PC, an architecture in which the server stores the machine's state and delivers software upgrades automatically whenever client PCs tap into a network.

All of these technical innovations will even alter how you buy software. In the future, Gates said, buying new operating software won't be a big event. Instead of your purchasing a box of software every two years, Microsoft will e-mail you updates customized to your usage patterns.

—Sebastian Rupley and Carol Levin

Wireless Video-conferencing

When a phone line is nowhere in sight.

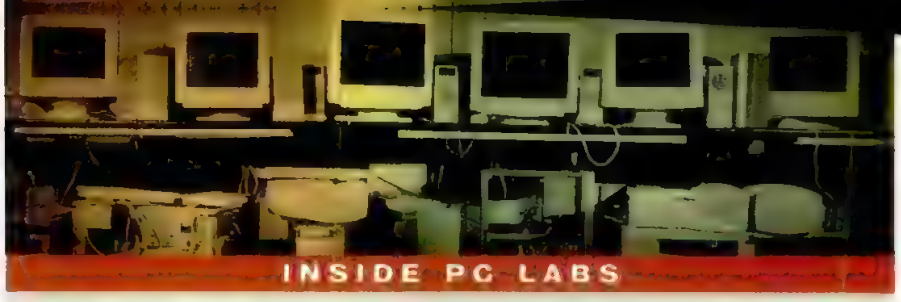
Mobile users are getting a lot of attention these days. A new standard in the works may one day allow you to participate in a videoconference by employing a souped-up phone, a laptop, or a PDA connected to a cellular network. But like any new complex technology—especially one based on cellular networks—wireless videoconferencing has its obstacles.

The proposed standard, called H.324/M, is currently on the drafting table of the International Telecommunications Union (ITU), the organization that is responsible for ratifying telecommunications standards. Because H.324/M is a superset of H.324, an international format for desktop videoconferencing over plain-old telephone lines, the standard will be compatible with existing videoconferencing software, which should help ease market acceptance. H.324/M will be put to a ballot vote in March 1997.

Portable videophones may be the first application to take advantage of the forthcoming mobile videoconferencing standard. So-called hybrid and smart phones function as phones, as PDAs, and as Internet-access devices, and, in time, could add videoconferencing to their list of features. So far, electronics manufacturers, such as Sharp, which is working to introduce video products into the Japanese market, are eyeing the technology.

Despite all of the interest, applications are a ways off—especially for North America. Notoriously error-prone cellular-phone networks present significant barriers to wireless videoconferencing, and few of the markets in the United States have established a Global System for Mobile Communications (GSM) network, which is currently the most viable network for wireless videoconferencing.

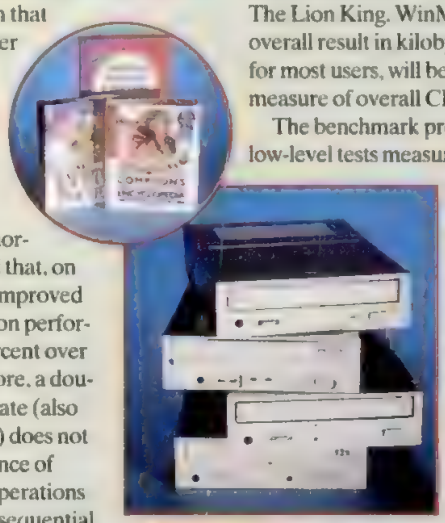
In the next several months, Boca Research, Intel, and PictureTel plan to introduce high-end PC-based videophones and receive-only video technology, but you'll have to wait a while longer for your mobile videophone.—*Angela Hickman*



Making Sense of the X Factor

CHIP DESIGNERS HAVE MANAGED TO DOUBLE the number of transistors on microprocessors about every 18 months, and if you think about it, CD-ROM manufacturers have forged as aggressive a performance curve: Five years ago 1X drives were the norm; by the end of 1996, 12X will be standard. But there's more to the CD-ROM performance progression than meets the eye. The nominal speed of a CD-ROM drive—identified by its numerical rating—doesn't always tell consumers exactly what they're getting. As one would expect, a drive with a higher speed rating (its effective data-transfer rate) will outperform one with a lower speed rating. But there are exceptions to the rule: A well-designed 6X subsystem can be faster than a 10X subsystem that has a small, slow buffer and a poorly tuned device driver.

In testing 10X and 12X CD-ROM players for this issue's feature story, "Here Today & Tomorrow," PC Labs found that, on average, 12X drives improved overall CD-application performance by only 20 percent over 6X drives. Furthermore, a doubling of the transfer rate (also called the "X" factor) does not double the performance of most CD-intensive operations (beyond large-block sequential reads). The X factor is a hazy measure of a CD-ROM drive's overall performance, particularly when the drive is integrated into a system and is performing application functions.



CD-ROM SPEED TRIALS: *The only reliable measure of performance is based on application testing.*

Among the many factors affecting CD-ROM subsystem performance are CPU utilization, buffer size, system interface type (Enhanced IDE or SCSI), and other characteristics (EIDE Mode 3 or 4; Programmed I/O versus bus-mastering; and more). Device-driver efficiencies, including read-ahead algorithms and host buffer management, can also affect performance. Lastly, slow CPU/memory, disk, and graphics subsystems, which are all involved to some extent in typical CD-application processing, can also dampen the impact of a fast subsystem.

To examine many of these other variables, we turned to our new ZD WinBench 97 CD-ROM and multimedia benchmark test suite, developed by Ziff-Davis Benchmark Operation (ZDBOp). The most significant test program for measuring comparative CD-ROM subsystem performance is our CD-ROM WinMark 97.

TESTING THE LION KING

CD-ROM WinMark 97 is based on profiles of usage patterns and CD-access characteristics for six popular CD-ROM applications, including Microsoft Encarta and Disney's The Lion King. WinMark 97 presents an overall result in kilobytes per second, which, for most users, will be the only reliable measure of overall CD-ROM performance.

The benchmark program also performs low-level tests measuring such factors as sequential read, access time, and CPU utilization. The results can help you analyze the CD-ROM WinMark scores and determine system headroom (the ability to do other tasks while reading data from the CD).

In creating our CD-ROM WinMark test, ZDBOp developers had to create a test file-system structure on our WinBench CD that closely matched the characteristics of the files and directories used by the profiled applications. File sizes and locations on the CD, number of CD sectors read per access, and access patterns (sequential versus random) were captured during profiling. These attributes are "played back" during the CD-ROM WinMark test to simulate the applications. Again, this test delivers the most realistic measure of comparative CD-ROM drive performance you'll find. After all, when it comes to CD-ROM speeds, you can't always trust the X factor.—*Nick Stam*

PHOTOGRAPHY BY THOM O'CONNOR; ILLUSTRATION BY TIM CARROLL

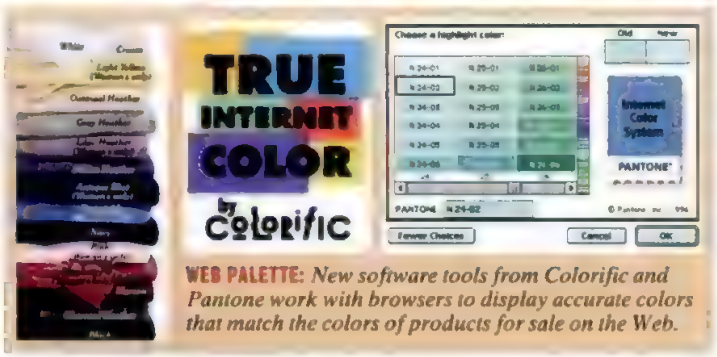
True-to-Life Color

Matching digital and real colors on the Web.

The number-one reason mail-order customers cite for product returns is a discrepancy between the color shown in the catalog and that of the actual merchandise. The difficulty of reproducing colors faithfully across a wide range of computer monitors is a major obstacle to Internet commerce. With major catalog companies champing at the bit to get onto the Web, graphics developers are eager to offer color-matching and color-management solutions for electronic documents.

Developers now have a number of palette-creation and management products to help. Pantone's ColorWeb, Digital Frontier's HVS Color 2.0, and Equilibrium's DeBabelizer for Windows will all generate a palette for Internet-safe colors (also referred to as the Netscape-protected palette). This palette is made up of 216 colors (the number is the result of subtracting the 40 system colors reserved by Window 95 from the standard 256-color palette).

Pantone's ColorWeb is a color-specification tool. A traditional paper-based swatch book supplements the electronic palette—the swatch book is printed using Pantone's Hexachrome inks in order to match RGB screen colors. Both HVS Color and DeBabelizer deal with Internet-safe colors within the context of image conversion and color reduction, producing 256-color .GIF images that don't conflict with browser palettes.



WEB PALETTE: *New software tools from Colorific and Pantone work with browsers to display accurate colors that match the colors of products for sale on the Web.*

The accurate on-screen representation of photographic colors, however, requires a more robust color-management solution. Pantone has announced extensions to its ColorDrive product that will let Web authors embed device profiles (called color tags) in TIFF and JPEG (but not yet .GIF) images. By themselves, these images are not color-corrected; they require a fully functional color-management module (CMM) on the client computer.

Here's how it works: After you download a color image from the Web, the browser invokes the CMM, which translates the color space of the source profile into accurate colors for your display. Pantone is making its own Pantone Open Color Environment CMM available to Windows users, along with a Netscape plug-in for making your Web browser color-management-aware. Pantone expects to ship the extensions to ColorDrive for Windows 95 in the first quarter.

Another take on Web color management transfers the burden of color transformation from the client PC to the Web server. The key component here is Sonnetech's Colorific/True Internet Color software, which uses a Java applet to produce an ICC-compliant profile of your display from within a Web browser. After creating the profile and storing it on your local drive, the Web server can use the information to transform color values in a picture prior to downloading the image for viewing. Theoretically, the Web server could download slightly different color data for every reader accessing the site.—*Luisa Simone*

JAKE KIRCHNER

Fight the Power! Fight the Power!

About network computers, let me say just this: If our corporate IT folks ever try to replace my personal computer with an NC, they better deliver the new hardware accompanied by a S.W.A.T. team, because I'm not giving up my PC without a fight.

Now that we've had our first look at some of the early examples of NCs, it's safe to declare publicly what most of us suspected all along: Anyone who thought that these limited devices would someday supplant PCs in offices and homes was kidding himself.

It's not that the NC is totally—to use a technical term—bogus technology. There are millions of dumb terminals that could be replaced by NCs. And there are millions of dumb terminal users who wouldn't know the difference. But anyone who has had even the most rudimentary experience with a "real" PC won't be satisfied with anything less. What we want is more functionality, more features, more memory, more power, and more fun—not a return to the days when the corporate mainframers ruled the world of information technology.

I guess it's no surprise that the people trying to foist the NC and similar devices on the world are from companies like IBM, Oracle, and Sun Microsystems—all longtime conspirators in league with the big-iron, glass-house, IT gestapo. We recognize them as the same technological Blackshirts who for the last dozen years have been promising to make client/server computing a success.

The remarkable thing is not that they've come up with yet another ploy to counter the Wintel hegemony, but that they think they can actually persuade corporations that the NC developers can pull together the networking, client hardware, and Java applications to turn back the 20 years of progress made in personal computing. They may fool some into thinking that NCs are the weapons that will roll back the costs of computing support and management, but they won't fool anyone who has come to rely on a PC for work, education, or entertainment.

I have no personal allegiance to Windows operating systems or Intel processors. If the next generation of PCs has us all running pure Java on 500-MHz PowerPC or MicroSPARC processors, I'll be perfectly contented—as long as I have all the memory, storage, and multimedia capability I'll need for the applications I choose for my own purposes, and as long as I can work offline when I want or need to.

I'd like to be confident that the long march of personal computing has made it impossible for the IT jackboots to make any serious incursion into the installed base of PCs. I know, however, that it's never safe to underestimate the forces of repression in the world. But I also know that the PC revolution is still in its infancy and suspect that if NCs make any headway in this fight, there are millions of home PC users standing ready to start smuggling their machines into their offices and join the battle once again.

PHOTOGRAPH BY SHONNA VALESKA

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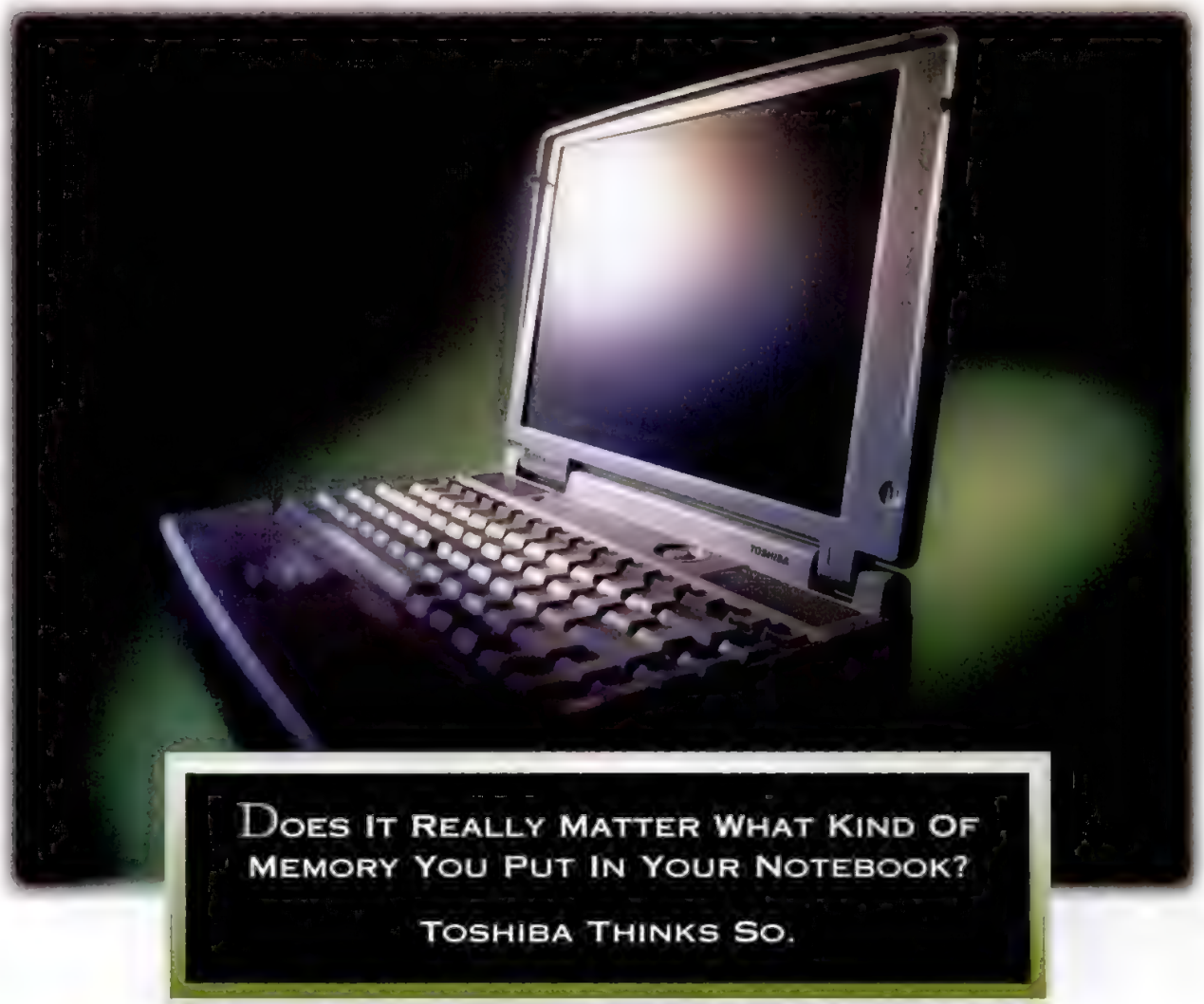
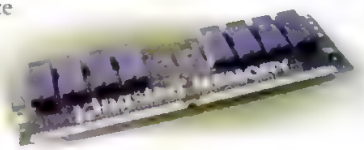


Recently, Toshiba America Information Systems took another important step to reinforce their position as the leading notebook computer manufacturer. They chose Kingston,® the world's leading memory manufacturer, to be the official supplier of their new Kingston Noteworthy™ Memory. This agreement marks the first formal endorsement of a memory company by a PC manufacturer. So why did Toshiba choose Kingston for their entire line of notebook and desktop personal computers? In a word, reliability. Kingston tests every cell on every chip on every module. (On a 32 megabyte module, that's 256 million cells.) And to guarantee compatibility, Kingston will design and manufacture memory modules to the exact specifications of individual Toshiba systems. Thanks to Kingston, Toshiba customers will also benefit from better availability and more competitive pricing on all memory upgrades. To find out more about how this alliance can benefit you, just call our toll-free number: (800) 337-8420. After all, if you already have the world's finest notebook, shouldn't you have the world's finest memory?



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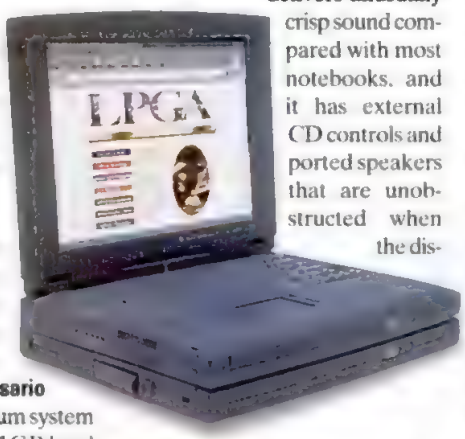
NOTEBOOK PCs

Notebooks on the Cheap

This issue's cover story, "Affordable, Portable Notebook PCs," evaluates 27 notebook systems from the value segment of the mobile market. Here are three notable new entries that we were unable to include in our roundup.

Compaq Computer Corp. (800-345-1518, *www .compaq.com*) is now extending its Presario line of home PCs to include the Presario 1000 series of notebooks. The $2,799 **Presario 1020** is a 120-MHz Penitum system with 16MB of RAM, a 1GB hard disk, and a high-quality, 11.3-inch SVGA dual-scan display backed by NeoMagic's 128-bit MagicGraph graphics chip set

The Presario 1020 has an integrated 6X CD-ROM drive and a 33.6-Kbps modem, but its leading features are its audio system and its touch pad. The Presario 1020 delivers unusually crisp sound compared with most notebooks, and it has external CD controls and ported speakers that are unobstructed when the display is closed. The touch pad has a unique set of navigation features. The Presario 1020 also supports both full-duplex speakerphone and answering-machine functions.



ON THE BASE: *TI Extensa 900 with its Mobile Productivity Base.*

We reviewed Texas Instruments' Extensa 605CD (800-848-3927, *www.ti.com*) for this issue's cover story; here we focus on the **Extensa 900**—a slim, 5.1-pound notebook. The $3,299 system has 16MB of EDO RAM, a 1.35GB removable hard disk, 256K of external cache, and a 12.1-inch dual-scan display. A front palm rest holds stereo speakers and a touch pad, while a side PC Card bay supports both Zoomed Port Video and Card Bus. The $599, 2.2-pound **Mobile Productivity Base** holds a second lithium ion battery, a modular bay for use with either an 8X CD-ROM drive or standard floppy disk drive (the floppy disk drive can also be used externally with the notebook), and a full set of ports.

Zenith Data Systems Direct's $3,299 **Zenith Z-Star GX 133** (800-261-7926, *www.zdsdirect.com*) uses the same design—manufactured by Full Power Investment—as three of the leading machines in our feature roundup: The Dell Latitude LM P-133ST, the ARM ARMNote TS96CD, and the Sceptre SoundX S4000T. Design highlights include NeoMagic's 128-bit Magic Graph graphics engine, a 133-MHz Pentium CPU, a 12.1-inch active-matrix display, and a modular bay that can accommodate either a 6X CD-ROM drive or a standard floppy disk drive. The Zenith PC weighs roughly 6 pounds and is equipped with 16MB of RAM, a 1.3GB hard disk, 256K of L2 cache, and an IrDA port.—*Cade Metz*

QUICK ACCESS: *The Compaq Presario 1020 Notebook: A unique design that leaves its CD-ROM controls unobstructed with a closed display.*

NOTEBOOK ACCESSORIES

Jazz Up Your Notebook

Even as Pentium notebooks creep ever closer to full desktop power, there are any number of accessories you can connect to enhance your system.

With prices of top-of-the-line notebooks hovering well above the $5,000 mark, the theft of a notebook can represent a major financial setback. **Port** (800-242-3133, *www.portinc.com*) now offers **DefCon 1**, a $49.95 portable theft-deterrence system.

The 6.2-ounce unit is about the size of a cellular phone and incorporates a 4.7-foot retractable steel cable, a motion detector, a combination lock, and a steel adapter that attaches to the security slot found in most notebooks. Once armed, the unit sets off a 110-decibel alarm if the cable is cut or if the unit is moved. The motion detector reacts if the notebook is moved in any direction. The system can also be used to protect the notebook's carrying case.

Another security device is the $39.95 **AlarmGuard** from Innovative Security Products (913-385-2002, *www.isecure .com*). The system consists of a 1-ounce transmitter, which attaches to the notebook, and a 3-ounce receiver, which can be worn in your pocket or clipped to your belt like a pager. Once you activate the receiver, it beeps if it is separated from the transmitter by a distance of either 10 or 20 feet.

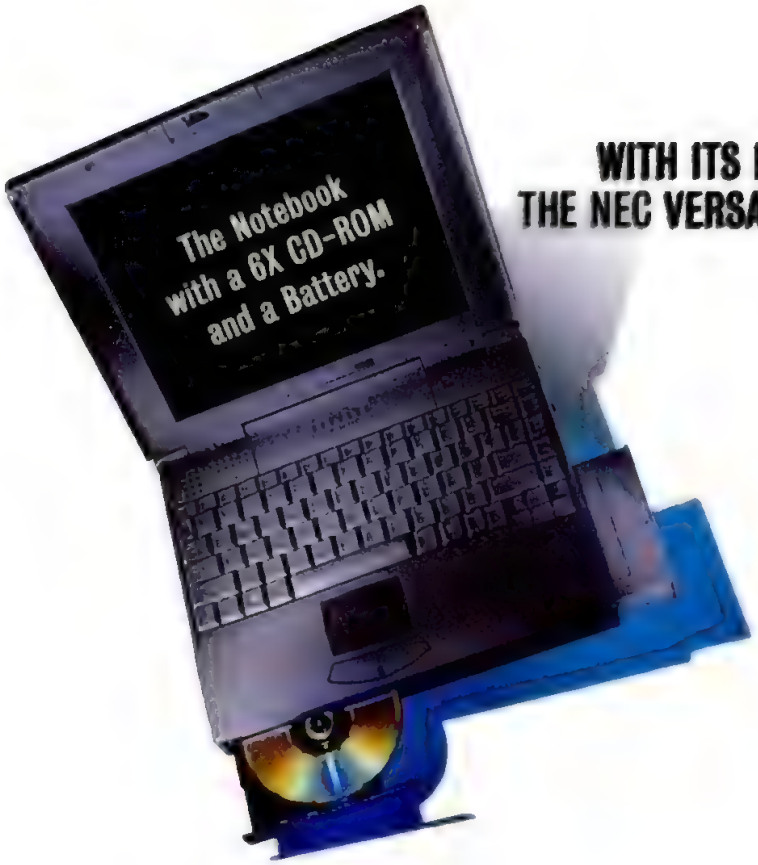
Port has also introduced a new line of shock-resistant notebook cases based on an air-cushioning system that uses urethane-encased, high-density foam cushions. Both the **Mobile Series** of lightweight cases (prices range from $79 to $149) and the **Sport Classic** line ($39 to $159) feature this new design.

DEFCON 1: *An easy way to protect your notebook.*

If you're in need of extra CPU power but don't want to retire your 486 notebook, H&P Engineering. (954-463-6770, *www.upgrade.de*) offers a number of user-installable CPU upgrades.

For example, its new $399 **586-150** plug-in CPU upgrade module offers the performance of a Pentium/100 CPU and is available for 486DX and 486SX notebooks from Compaq, IBM, and Toshiba notebooks. H&P also offers processor and BIOS upgrades for notebooks with CPUs that are soldered on to the system's motherboard.

Avatar Systems Corp. (408-321-0110, *www.avatarltd.com*) recently increased the capacity of its 2.5-inch $450 **HARDiskette** removable-cartridge drive system from 170MB to 210MB. The cartridges have an average access time of less than 12 ms and an average data-transfer rate of 2.5 MBps, making them comparable in performance to standard nonremovable hard disks. The Avatar HARDiskette drives are available as standard drive bay options for notebooks from Acer America, Texas Instruments, and other vendors.—*Robert S. Anthony*



WITH ITS INTERCHANGEABLE COMPONENTS, THE NEC VERSA 2400 IS ACTUALLY 4 NOTEBOOKS IN 1.

Just slip the 6X CD-ROM drive and battery into the two modular VersaBay™ slots, and your NEC Versa® 2400 changes into a state-of-the-art multimedia tool for brilliant on-the-road presentations.

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Up to 1.08GB hard drive

11.3" DSTN color display

*Two VersaBay slots***

Two high-output stereo speakers

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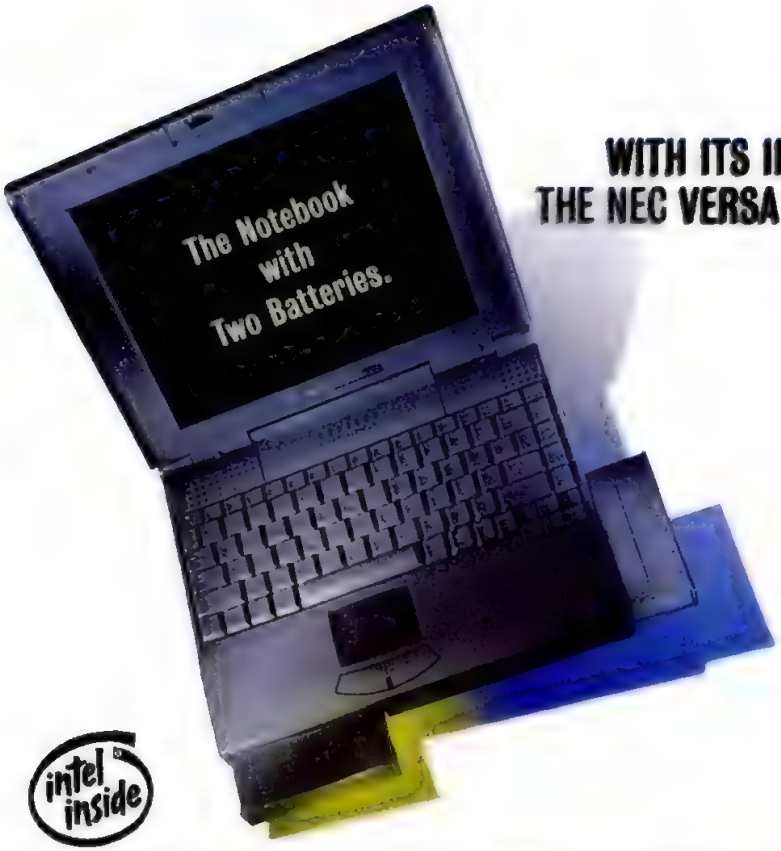

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Just insert both batteries† into the two modular VersaBay slots, and your NEC Versa 2400 becomes a notebook with enough juice for up to 6 hours of nonstop computing.

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Intel Pentium® Processor up to 133MHz

Up to 16MB EDO DRAM

Up to 1.08GB hard drive

11.3" DSTN color display

*Two VersaBay slots***

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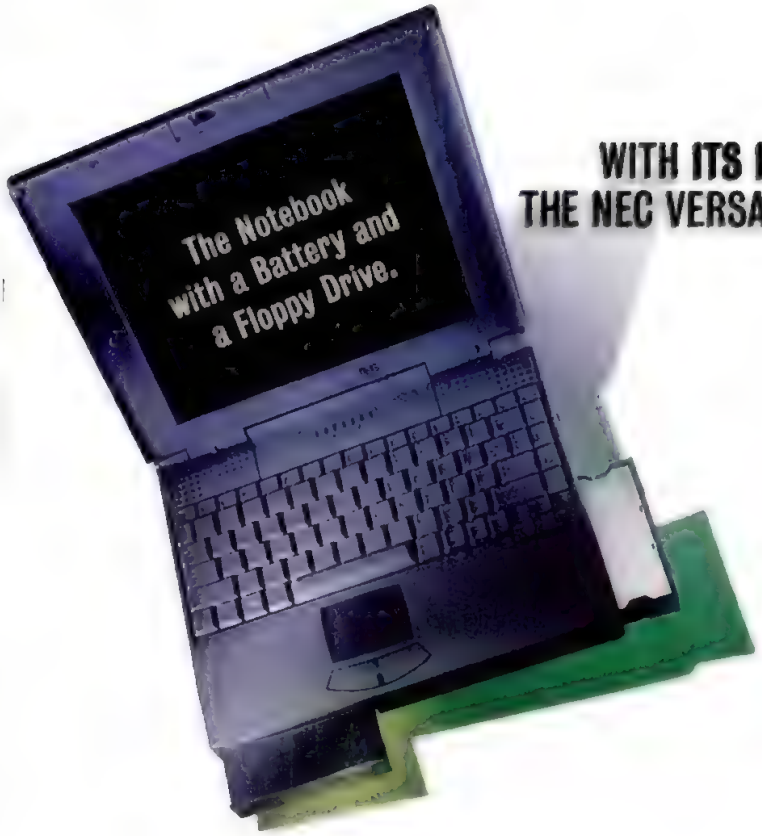

WITH ITS INTERCHANGEABLE COMPONENTS, THE NEC VERSA 2400 IS ACTUALLY 4 NOTEBOOKS IN 1.

Pop the battery and the floppy drive into the two modular VersaBay slots, and your NEC Versa 2400 turns into a notebook that will effortlessly store and transfer data wherever you are.

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Up to 16MB EDO DRAM
Up to 1.08GB hard drive
11.3" DSTN color display
*Two VersaBay slots***
Two high-output stereo speakers
Two PC Card slot
MPEG video

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WITH ITS INTERCHANGEABLE COMPONENTS, THE NEC VERSA 2400 IS ACTUALLY 4 NOTEBOOKS IN 1.

Slide the 6X CD-ROM drive and the floppy drive into the two modular VersaBay slots. On AC power, your NEC Versa 2400 transforms into a powerful multimedia notebook that will rival a desktop computer.

*NEC Versa 2400 Series starting at $1999**
Intel Pentium® Processor up to 133MHz
Up to 16MB EDO DRAM
Up to 1.08GB hard drive
11.3" DSTN color display
*Two VersaBay slots***
Two high-output stereo speakers
Two PC Card slot
MPEG video

SEE, HEAR AND FEEL THE DIFFERENCE.™

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Difference and VersaBay are trademarks of NEC Technologies, Inc. used under license by Packard Bell NEC, Inc. **The CD-ROM drive comes standard on some models. †The additional battery is optional and must [illegible]

CIRCLE 107 ON READER SERVICE CARD

HELP-DESK SOFTWARE

Help is Just an App Away

If your job is to solve other people's computer problems, help-desk software can make your work day easier. Some help-desk products have recently incorporated Internet and multimedia features, so that tech support administrators and end users can find quicker and easier answers to computer-related questions.

PERSONAL ASSISTANTS: *SmartTrainer HelpDesk's Show Me feature lets you experience the problem-solving process.*

Professional Help Desk (800-474-3725, *www.prohelpdesk.com*) offers a three-step solution for problem resolution. The company's help-desk software, **Professional Help Desk for Windows** ($2,995 for one user) retrieves answers to common questions from an information base, employs experience-based reasoning for solving tougher problems, supplies in-depth diagnoses of reported problems, and recommends solutions. The package— Version 4.1—runs on Microsoft Windows 3.1, Windows 95, and Windows NT, as well as OS/2 for Windows.

Manage-It!, Version 1.75 enables technical-support administrators to gather customer information that relates to a specific type of support call. Priced at $249 per workstation or $1,100 for a five-user package, this product from Baron Software Services (516-292-2323, manageit@bssinc.com) lets you perform logging, query, search, and reporting tasks. Manage-It!, Version 2.0 will include improved searching and security capabilities, an enhanced user interface, and a more in-depth information database.

CALL TRACKER: *Professional HelpDesk allows you to track detailed information about callers.*

SmartTrainer HelpDesk ($995 for 12 users), from Anderson Soft-Teach (800-338-4336, *www.teach.com*), focuses not on assisting tech support administrators but on helping end users solve their own problems. It provides multimedia training for Windows 3.1, Windows 95, and Windows NT, as well as Microsoft Office 4.3 and 95. From within Microsoft Word or Excel, for example, users can jump immediately to training by clicking on SmartTrainer's icon.

With its multimedia element, SmartTrainer works like a live guide; its Show Me mode uses not only text and graphics but full-motion video and audio as well to enhance its explanations. A Try It option lets you practice hands-on while a coach talks you through each step.—*Yvonne Koulouthros*

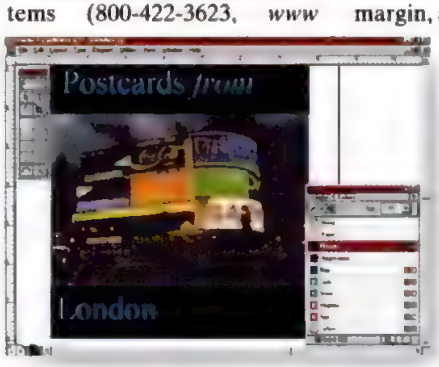
DESKTOP PUBLISHING

Do-It-Yourself Publishing

Sometimes it's just easier to do things yourself. Which is one reason why desktop publishing packages that target the home and small-office markets sell so well.

Corel Corp.'s $895 Corel Ventura 7, a powerful program that addresses both traditional and online desktop publishing, has gotten a complete overhaul (800-772-6735, *www.corel.com*). This 32-bit package lets you publish documents to the Web and to electronic Novell Envoy files, and it uses Corel's Barista technology for WYSIWYG publishing with HTML and Java. There's support for SGML, OLE 2.0, multiple master pages, and workgroup publishing controls. Corel Ventura comes bundled with nine other Corel applications, including Corel WordPerfect 7, Corel PhotoPaint 6, and Corel Database Publisher.

Catering to graphics and publishing professionals is **Adobe PageMaker 6.5**, from Adobe Systems (800-422-3623, *www.adobe.com*). The 32-bit package now offers support for Microsoft Windows 95 and Windows NT 4.0 Workstation. New features include objects on different layers of a document, the ability to place hypertext linking, and automatic conversion of graphics to .GIF and .JPEG for creating documents that are ready for publication on the World Wide Web. This version also has an automatic layout adjustment feature that makes it easier to change column, margin, and page sizes without reflowing text into columns, resizing graphics, or repositioning.



PERSONAL PUBLISHER: *Adobe PageMaker 6.5.*

Microsoft Corp. (800-426-9400, *www.microsoft.com*) is offering the $79.95 **Microsoft Publisher 97**, an appealing package for home and small-office users. This versatile program now has a Web Site Wizard that makes it easy to design and post Web pages. The Wizard walks you through each step, helping you place text, graphics, design elements, and navigational links. Also new to Publisher is a Postcard Page Wizard that simplifies the creation of marketing and direct-mail pieces, a design checker that appraises both document and Web page layout, 5,000 pieces of clip art (including elements whose resolution is optimized for the Web) and mail-merge, for importing address lists from Microsoft Access, Microsoft Word, and other programs.

At the lower end of the spectrum is IMSI's $29.95 **Master Publisher Premium Publishing Suite** (800-833-8082, *www.imsisoft.com*). The package includes TurboPublisher, a basic design package that offers the templates and tools to create everything from booklets to brochures, business cards, and posters. TurboPublisher has customizable tool bars, wizards, OLE 2.0–compatible support, and a feature that helps you to design logos. The suite also includes TurboDraw for a vector-based graphics editor and thousands of clip-art images, fonts, and photos culled from the MasterClips 35,000 Premium Image Collection.—*Melissa J. Perenson*

NETWORK LASER PRINTERS

A Laser for Every Network

NEW BURST OF LASERS: *Underscoring the variety of network laser printers available are (from left to right) the Kyocera FS-1700, the Sharp AO-4100P, and the Brother HL-1660.*

With ever-faster engines and ever-declining prices, network laser printers are an increasingly good value. There's a wide array of solutions for any size network environment, thanks to new rollouts by Brother, Kyocera, QMS, Sharp Electronics Corp., and Xerox that cover speeds ranging from 12 to 40 pages per minute (ppm).

For low- to mid-volume network printing, Kyocera's answer is the $1,645 **FS-1700** (800-232-6797, *www.kyocera.com/printers*). Rated at 12 pages per minute, its KIR[2] (Kyocera Image Refinement) software provides resolutions of up to 2,400 by 600 dpi, and its PrintMonitor lets you control print jobs remotely.

RECAP In our June 11, 1996, roundup of 11 workgroup and departmental laser printers, Editors' Choices were awarded to the
- HP LaserJet 5M
- HP LaserJet 5siMX
- QMS 2425Ex Print System

The **HL-1660 Series** of laser printers, from Brother (800-521-2846, *www.brother.com*), starts at $1,450 and comprises three 17-ppm models with resolutions of up to 1,200 by 600 dpi. Brother's Advanced Photoscale technology (APT) lets you print Microsoft Windows files with up to 61 levels of gray scale at 150 lines per inch and as many as 256 shades of gray.

The latest offering from QMS (800-523-2696, *www.qms.com*) is the **2060 Printer Series**. With prices starting at $1,999, these five models have 20-ppm engines and print edge to edge. The WX, BX and GX models deliver 600- by 600-dpi resolution, while the EX delivers 1,200 by 1,200 dpi. The BX, GX, EX, and ImageServer printers use QMS's Crown multitasking technology, known for its fast document throughput and seamless network connectivity.

Targeting high-volume, industrial-strength markets is Xerox (800-349-3769, *www.xerox.com*), which is readying its $13,495 **DocuPrint 4232**. The unit is rated at 30 ppm, has 600- by 600-dpi resolution, supports printing transparencies and labels, and utilizes Xerox's new CentreWare DP management software.

Sharp (800-237-4277, *www.sharp-usa.com*) ups the ante with its $27,995, 40-ppm **AO-4100P**. It sports a 200MB hard disk, a floppy disk drive, 3,000-sheet paper input capacity, and remote-management software. The inclusion of the hard disk and floppy disk drive lets you load new features, enhancements, and emulations. You can even swap paper and toner while printing.—*Toni Kistner*

PORTABLE CD-ROMs

You *Can* Take It with You

Unable to justify extravagant upgrade costs, many business travelers still avert their eyes from notebooks equipped with CD-ROM drives. But now there's a way to keep your trusty system and still find multimedia happiness: Simply add one of the new, high-speed portable CD-ROM drives that have hit the market.

The **KXL-783A** 8X CD-ROM drive from Panasonic (800-742-8086, *www.panasonic.com*) weighs in at about 19 ounces and connects to notebooks via a Type II PC Card, and to desktops equipped with a SCSI-2 interface. It features a 1,200-KBps transfer rate, 180-ms access time, and a 128K memory buffer. Integrated Spatializer 3-D stereo speakers give the drive exceptional sound quality, and the headphone jack lets it double as an audio CD player. Six AA batteries provide about 3 hours of CD-ROM usage and 3.5 hours of audio playback; a rechargeable battery pack is also available. A handy power-save feature puts the drive in a low-power sleep state after 4 minutes of inactivity.

ON THE GO: *The KXL-783A, a portable CD-ROM drive from Panasonic.*

Sony Electronics Corp. (800-352-7669, *www.sel.sony.com*) also has a lightweight solution in the **PRD-650 Discman**. This 6X drive features a 900-KBps transfer rate, 280-ms access time, and a 128K memory buffer. Weighing a mere 10 ounces, the Sony connects to your notebook via a standard Type II PC Card or to your desktop via a SCSI-2 cable. It uses four AA batteries for 2 hours of play or a rechargeable $59 lithium-ion battery, which delivers 2 hours of CD-ROM playback or 8 hours of audio.

Axonix Corp. (800-866-9797, *www.axonix.com*) recently introduced the $429 **ProMedia 8XR**, a portable external 8X CD-ROM drive. The 20-ounce, Plug and Play–compatible unit, which connects to a notebook via a proprietary interface cable and a Type II PC Card, supports data-transfer rates of up to 1.2 MBps. The ProMedia 8XR taps its power from the host notebook, thus eliminating the need for either batteries or an AC adapter. The unit is also available with a serial-port connection, under the name ProMedia 8XRP. This model, which is also priced at $429, comes with a special two-plug connector, which allows a printer and the CD drive to plug into the serial port simultaneously.

RECAP We reviewed four portable CD-ROM players in our issue of August 1996. An Editors' Choice was awarded to the Altec Lansing ACS-2800.

For a more detailed look at the speediest crop of CD-ROM drives for the desktop (10X and faster), see "CD-ROM Drives: Here Today and Tomorrow" in this issue.—*TK*

Sony Picture Quality

Super Fine Pitch™ Trinitron Tube

Multiscan® Technology

Accurate Focus Corner to Corner

Sony Engineering

Vertically Flat Screen

Higher Resolutions & Refresh Rates

Digital On-Screen Controls

Sony Advantages

Broad Family of Displays

National Service and Support

Windows® 95 Plug and Play

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Vivid, accurate color. Trinitron® technology.
Inspiration comes and goes in an instant.
Bring yours home on a Sony.

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SONY

INTERNET SERVICE PROVIDERS

Access for Everyone

BRIDGING THE GAP: *Brigadoon.com's Internet Bridge adds community as an aspect of its service.*

As the number of people connecting to the Internet through direct Internet service providers (ISPs) grows, everyone from the regional telephone companies to your entrepreneurial neighbor is looking to offer Internet access. Three companies take varied approaches to provide Internet access in every corner of the country.

AppliedTheory (800-493-4367, *www.appliedtheory.com*), the for-profit offshoot of NYSERNet, is taking its long-term regional experience and offering national Internet service. AppliedTheory expects to profit from NYSERNet's reputation as the nation's first ISP to the corporate world—in the 1980s NYSERNet introduced such clients as Eastman Kodak, General Electric, IBM, and NYNEX to the Internet. With almost ten years of Internet experience, AppliedTheory plans to woo companies that want to develop a commercial presence on the Internet and the World Wide Web by providing such services as commercial transactions and interactive media. It is also offering standard and customized on-site training for businesses. Prices for access start at $4,000 a year.

Brigadoon.com (800-318-2504, *www.brigadoon.com*), formerly a small regional ISP focused primarily on rural areas, now has POP sites in 250 metropolitan areas in 47 states. For a flat fee of $17.95 per month, individuals get unlimited local Internet access as well as 2MB of server space to create their own Web sites. An optional content-filtering service is provided for an additional $2.95 per month, giving parents control over what sites their children can access. Access accounts for small businesses start at $29.95 per month.

Brigadoon.com, whose services are available through Microsoft's Internet Referral Server program, distinguishes itself from the major ISPs by offering community-based affinity marketing. This approach lets local schools and nonprofit groups earn a percentage of the monthly fee paid by everyone who signs up for Internet service through the sponsoring organization. The revenue received by the sponsoring organization generally pays for Internet access for its students or members.

RECAP *Internet service providers were last reviewed in the issue of November 19, 1996. Editors' Choice awards were given to*
- *America Online*
- *SpryNet*

Community-based content is also offered via Brigadoon.com's Internet Bridge, which lets community organizations create neighborhood Web pages featuring anything from PTA meetings to local sporting events.

If your neighborhood could use an ISP, why not start one of your own? **First Internet Franchise Corp.** (800-617-4227, *www.fifc.net*) gives entrepreneurs the opportunity to buy a franchise specifically tailored to bring Internet access to rural areas generally ignored by other ISPs. First Internet has partnered with such industry notables as Mustang Software, U.S. Robotics, and Worldcom to create an attractive business opportunity for anyone who sees a gap in local Internet accessibility. The franchises are priced from $23,900 and include a training program, marketing and advertising materials, hardware, and software.—*Nancy Hirsch*

HTML AUTHORING TOOLS

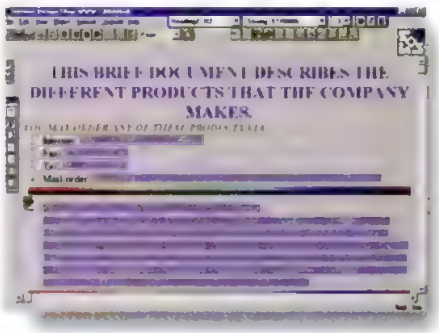
Making Web Pages Easier

Enterprising companies continue to innovate in the HTML authoring tool market, appealing to different users while increasing the sophistication of the tools.

Brooklyn North Software Works (902-425-0900, *www.brooknorth.com*), an HTML authoring pioneer, has released the $99.95 **HTML Assistant Pro 97**. HTML Assistant now features Site Assistant and Quick Publish, enabling you to manage your site and upload Web pages from within the program. A built-in word processing conversion tool eases the process of moving legacy documents to the Web.

RECAP *PC Magazine reviewed 16 HTML authoring tools in the issue of September 10, 1996; Microsoft FrontPage 1.1 won our Editors' Choice award.*
Our First Looks roundup of six Web authoring packages appeared in the issue of November 19, 1996. An Editors' Choice was awarded to NetObjects Fusion.

You can easily add ActiveX objects, Java applets, and JavaScript to your pages through forms that require no HTML programming. QuickFrames lets you add frames by selecting the style you'd like; HTML Assistant builds the frames for you. New HTML tags and features can be added to the program and accessed through customizable toolbars. You can check your work in multiple browsers to ensure that everyone can view your site.



HEADSTART: *Internet Design Shop offers a variety of templates.*

Internet Design Shop 3.2, from Boomerang Software (617-489-3000, *www.mosaiccom.com*), is a complete suite of Web design publishing tools. Priced at $49.95 and available for Microsoft Windows 3.1, Windows 95, and Windows NT 4.0, Internet Design Shop integrates an image-and-graphics editor, drawing tools, calendaring functionality, charting and presentation tools, and a selection of clip art along with its WYSIWYG editing capabilities. In case you prefer to use other tools for specific tasks, you can link them to Internet Design Shop as helper applications.

With Internet Design Shop's charting and presentation module, you can select from any of 50 chart variations and create 3-D graphics on your page. You can add Java or JavaScript via a simple form whose parameters you set. The program provides a host of templates to help you get started, and you can create your own templates as well.

Both companies offer limited versions of their HTML editors for trial use; they can be downloaded from the companies' respective Web sites.—*David Lidsky*

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Small companies that want to use e-mail, the Web, and firewalls no longer have to face the financial and integration headaches of separate packages. New multifunction connectivity devices and services give small companies Internet and LAN connectivity similar to a Fortune 500 company.

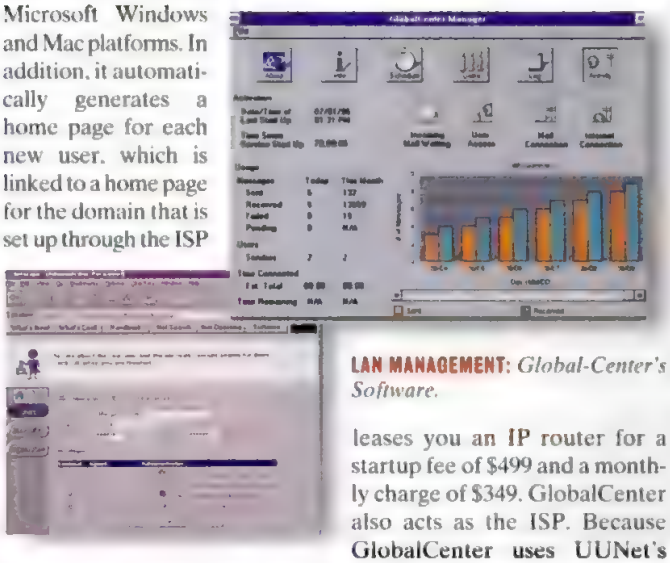
The $4,995 **IPS-168**, from i-Planet (408-745-1500, *www.i-planet.com*), attaches to any TCP/IP-based LAN and provides features ranging from Internet e-mail and Web server functionality to remote access, proxy servers, and browser-based administration and management. The IPS-168 has a 100-MHz Pentium CPU, 16 MB of RAM, 1.6GB of storage space, an Ethernet port, two serial ports, and two internal 28.8-Kbps modems for data and fax. A dual-Ethernet or a T1 version are available for an additional $1,000. The parallel printer port lets the unit double as a print server.

The IPS-168 acts as a gateway between your LAN and ISP. It supports the DNS (Domain Name Service) protocol and Dynamic Host Configuration Protocol (DHCP), automatically supplying end users with IP addresses and maintaining the host address. There's also support for IMAP, POP2, POP3, and SMTP e-mail. The built-in firewall consists of a packet filter and application gateways for a wide array of IP protocols. Additional security is provided by seven built-in proxy servers.

The $1,995 **InterJet 100**, from Whistle Communications (888-494-4785, *www.whistle.com*) offers a similar array of features without quite as much depth or security as the IPS-168. Shaped like a toaster and 9 inches tall, the InterJet 100 provides your Ethernet LAN with dial-up access with speeds of from 28.8 Kbps to ISDN, and it can be upgraded to frame-relay speeds (56 Kbps and T1).

The InterJet 100 runs on a 75-MHz 486 and houses a 1GB hard disk and 8MB of RAM. Connections include a high-speed serial port, a 33.6-Kbps modem, and a four-port 10Base-T hub. A version with 2GB of storage and 16MB of RAM will be available by the time you read this, and the unit can be scaled to accommodate upwards of 100 users. Most setup and configuration happens once the InterJet 100 is connected to your ISP, which interrogates the unit and guides the administrator through a graphical setup program. The WhistleWare software package includes an e-mail server that supports POP3, IMAP, and SMPT; an HTTP server; and file sharing for both Microsoft Windows and Mac platforms. In addition, it automatically generates a home page for each new user, which is linked to a home page for the domain that is set up through the ISP during the initial setup call. The Interjet's built-in Unix-based firewall features SSL security and packet filtering. The Unix interface is hidden under the InterJet's GUI, and therefore protected from access by potential hackers. In addition, TCP/IP addresses are hidden from the outside world by Whistle's address scheme.

THE INTERJET 100 *from Whistle Communications.*



LAN MANAGEMENT: *Global-Center's Software.*

GlobalCenter (408-328-6000, *www.globalcenter.net*) offers a subscription-only service for connecting your LAN to the Internet. Rather than selling you a modified PC, GlobalCenter leases you an IP router for a startup fee of $499 and a monthly charge of $349. GlobalCenter also acts as the ISP. Because GlobalCenter uses UUNet's backbone, it already has more than 300 points of presence in the U.S. The router can give your LAN either a V.34 or ISDN connection and supports IP and Mac TCP protocols. Up to 128 IP addresses can reside on the router; the administrator, however, needs to visit each desktop to install the license. There is no per-user pricing; the monthly fee is for unlimited access. The dial-up data center provides several firewall layers in addition to the basic security inherent in a proprietary dial-up system.—*David S. Lambert*

UTILITIES

Solutions for the Year 2000

The year 2000 steals ever closer, and so far no cookie-cutter solutions have emerged to solve the date-conversion problem. New services and tools are cropping up daily to deal with what the Gartner Group claims will be a $600 billion issue.

The **Trans2000** package, from Transition Software Corp. (610-377-2500, *www.transition-software.com*), provides inventory, conversion, and testing tools for mainframe systems. Trans2000 is divided into five subsystems. The $65,000 Encompass2000 creates a complete set of reports of your date fields but of the relationships between files and programs as well. The reports give a clear picture of how your system works and how to proceed with conversion. For $35,000, Plan2000 helps you divide your overall system into separate projects to be converted one at a time, saving you from having to take your whole system off-line at once.

The other three segments comprise the Trans2000 Production Suite, and pricing is based on the amount of code Encompass2000 decides needs converting. The suite creates project plans for each subsystem defined by Plan2000, maintains bridges between converted and nonconverted subsystems, and automates your code conversion.

While much of the focus of the Year 2000 industry has been on mainframes such as AS/400 systems, Accelr8 Technology (303-836-8088, *www.accelr8.com*) is working on solutions for VAX/VMS-based networks. A shrink-wrapped version of the **Navig8-2000** diagnostic tool, complete with a user-friendly GUI, is expected in the first quarter of 1997. Currently, Accelr8 uses the Navig8-2000 software in-house to examine your code for 7-15 cents per line. This service, called Solution 2000, is an impact study whose results will let you know how much of your code is affected by the date issue and offer solutions you can implement yourself. —*DRL*

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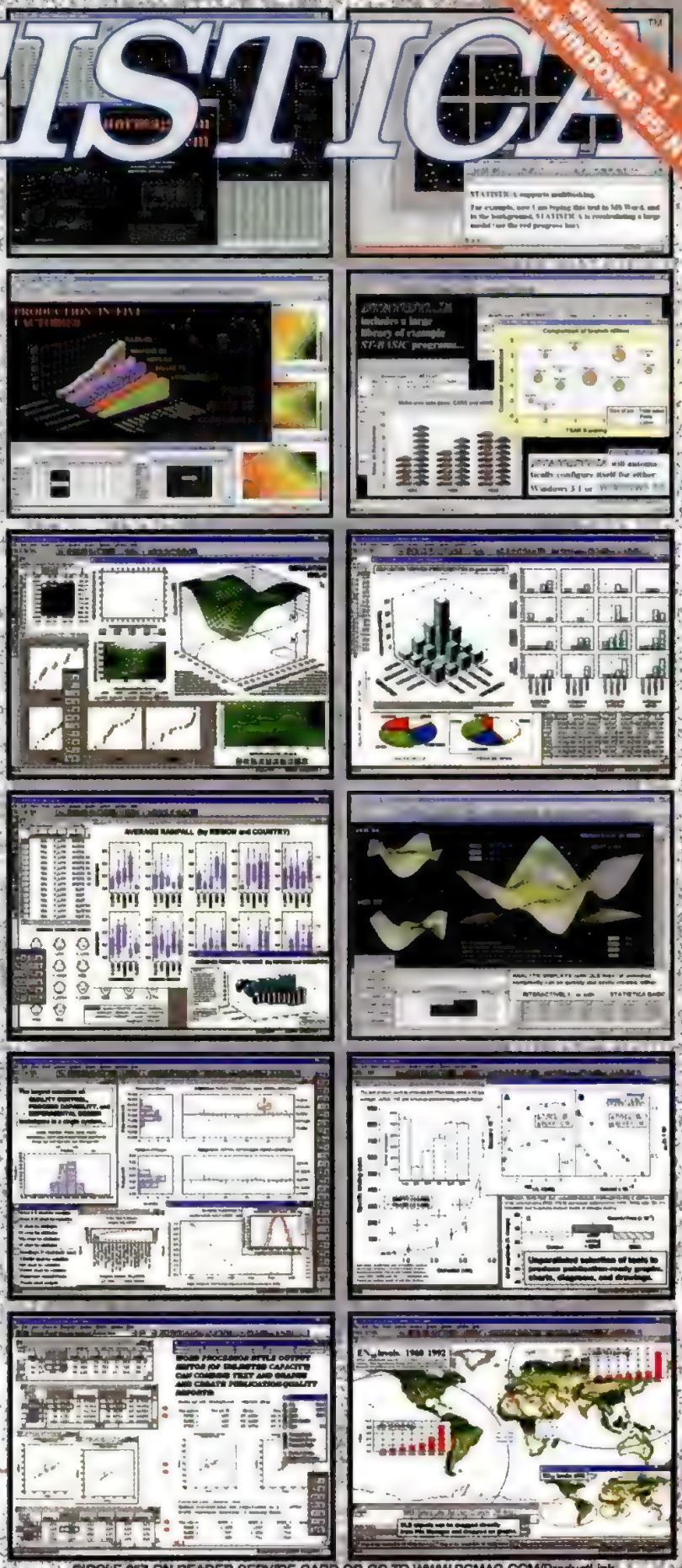

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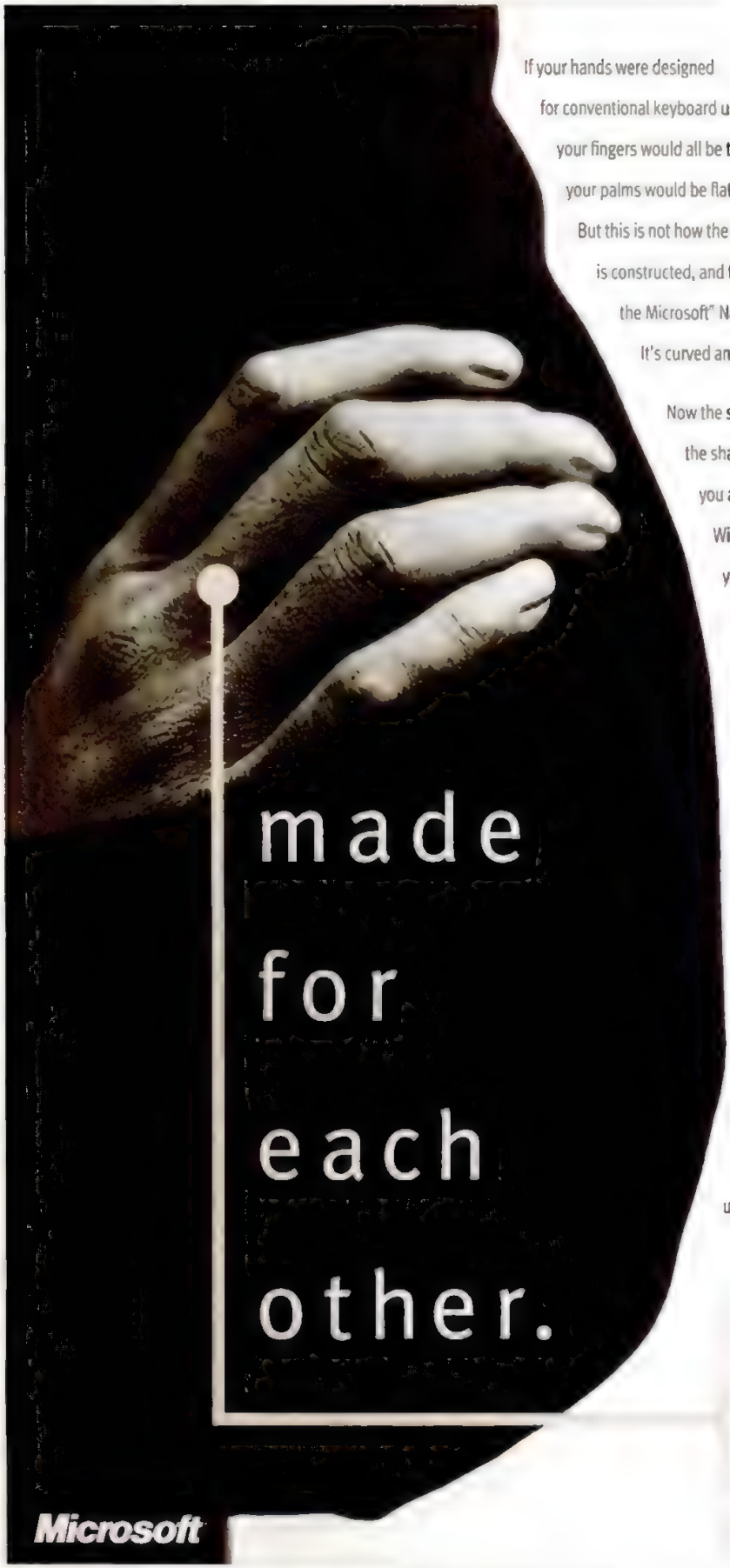

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First Looks

Pocket Windows

These first three Windows CE systems put the computing world in the palm of your hand.—By Sebastian Rupley

Year after year, PDAs, or personal digital assistants, fail to capture the imagination of computer buyers or fulfill the rosy expectations of industry analysts, pundits, and gurus. Now one of the most far-reaching efforts to breathe life into the moribund hand-held computer market is converging around the latest member of the Microsoft Windows family: Windows CE.

Clockwise from top: the Casio Cassiopeia A-10, NEC MobilePro 400, and Philips Velo 1.

Code-named Pegasus, Windows CE is a 32-bit, multitasking operating system that has the look and feel of Windows 95. Windows users will feel right at home, from the Start button, to Windows Explorer, to the stripped-down versions of such Windows applications as Pocket Excel and Word (For more information, see "Windows in Your Palm," January 7, 1997). Designed to operate with a compact 4MB of RAM, Windows CE is graphical computing stripped to its essentials.

Consumer electronics companies and traditional PC makers alike have rallied around the operating system by producing a new generation of HPCs, or hand-held PCs. We got our hands on the first three devices: the $499 Casio Cassiopeia A-10, the $649 NEC Electronics MobilePro 400, and the $699 Philips Velo 1. Months of speculation hinted that these svelte Windows systems would be aimed at price-conscious consumers looking for a step up from a Wizard or Boss electronic organizer, but the first HPCs offer a range of palmtops, from $500 electronic organizers on steroids to enterprise sidekicks for networked PCs priced at about $700.

The majority of Windows CE systems will probably be users' second—and in many cases third—PC. The big bang for the buck with these miniature systems comes from their ability to take advantage of the familiar Windows interface. Earlier PDA-centric operating systems tried (without much success) to build proprietary interfaces around communications tasks and not-so-trustworthy handwriting recognition. The missing element has been applications that go beyond the standard word processor and spreadsheet programs.

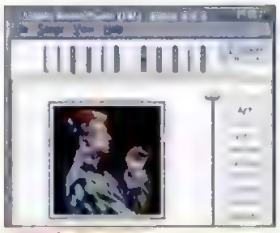
These Windows CE systems, however, offer the possibility of porting just about every 32-bit Windows application ever written. Many programs have too small an audience to make it to a PDA near you. Others are inappropriate due to Windows CE's reliance on a small monochrome display. But if only a few out of a hundred are ported to Windows CE, the number of available applications will quickly overtake those written for other PDAs.

The applications that come with these first Windows CE PDAs—Pocket Excel, Pocket Word, Version 2.0 of Internet Explorer, and an assortment of file-transfer and -synchronization utilities—are the tip of the iceberg. To add to its own Windows CE applications, Microsoft cites over 90 application developers who have Windows CE add-ons

INSIDE

TAKES A LICKING: Panasonic's new notebook, the CF-25, handles everything you can dish out. *Page 54.*

1-800-BROWSE: Talk and browse the Web on the run with AT&T's PocketNet Phone. *Page 64.*



AUDIO ON TAP: Liquid Audio's MusicPlayer delivers CD-quality sound over the Net. *Page 73.*

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PC MAGAZINE ONLINE

PHOTOGRAPHY BY GEOFFREY NELSON

Editors' Choice

• Philips Velo 1

Among this trio of Windows CE palmtop computers, one stood out by delivering the goods in terms of performance, upgradability, and peripherals. The Philips Velo 1 put it all together: It's the fastest, most expandable, most richly configured, and best designed unit of the bunch, making it our Editors' Choice for the first wave of Windows CE systems.

Unlike the competition, which opted for PC Card–based data communications, the Velo 1 stands out from the crowd by including a V.32bis modem, which is capable of a maximum throughput of 19.2 Kbps for transferring files and sending faxes. Combined with its MIPS R-3900 CPU, it was the fastest of the three at a variety of common tasks. And there's the bonus of the Velo 1's Voice Memo application, which turns the built-in microphone and speaker into a usable recorder for brief voice memos or sound bites. The Velo 1 also includes a copy of Intuit's Pocket Quicken, a boon to those who want to jot down expenses electronically or review the family's finances.

Both Casio's Cassiopeia A-10 and NEC's MobilePro 400 aimed lower on the PDA scale. The Cassiopeia A-10, which comes with 2MB of RAM (compared to 4MB for the other two systems), is basic through and through, while the MobilePro puts its emphasis on providing file-transfer and -synchronization utilities.

Despite its higher cost, the Velo 1's built-in modem, excellent expandability, top-flight performance, and unique software applications earn our nod as the best of the first group of Windows CE systems. The Velo 1 gives us hope that PDAs may catch on.

in the works, including DataViz and Puma (file-conversion and -synchronization utilities), Symantec (contact-management applications), and Wright Systems (mobile forms programs).

Many of these applications aren't out yet, so some users parked in front of Pocket Excel and Pocket Word on a Windows CE palmtop may be disappointed. They should remind themselves, however, that spreadsheet and word processor programs made their way to PDAs due to the early efforts of such PDA pioneers as Hewlett-Packard (the LX series of PDAs) and Sharp (the Zaurus series of PDAs). With Windows running on these palmtops, the promise of a wave of applications ported to Windows CE can't be dismissed.

The weak link in the PDA chain remains the obligatory small, monochrome LCD panels. The tiny, rudimentary screens that adorn these units don't exactly afford panoramic views of Web pages; for that matter, they don't even offer even the luxury of color. After years of using large color monitors or portable active-matrix screens, many will be turned off by the 640- by 240-pixel, gray-scale screens that each of these PDAs use to display information.

TO EACH HIS OWN

The three systems we tested had a lot in common. Each fits easily into a jacket's breast pocket, a briefcase, or a handbag, weighs in at about three-quarters of a pound, and runs on a pair of AA batteries for about 20 hours of use. Two particular inconveniences stand out, though: You must have e-mail filtered through a POP3 server, and you have to input data by using a combination of the unit's cramped (but serviceable) QWERTY keyboard and its stylus on the pressure-sensitive screen. During evaluation, we frequently found ourselves finger-tied and wondering what to do with the stylus.

BLUE-LIGHT SPECIAL: *At just $499, Casio's Cassiopeia A-10 set the pace as the least expensive Windows CE system available.*

Although these PDAs look alike from a distance, a closer examination shows that each has a different focus and configuration. The Velo 1, which is clearly positioned for the enterprise user, was the only PDA to include a built-in V.32bis modem; the others depend on PC Card modems for communications support. In addition, the Velo 1 is the most expandable, with a maximum RAM ceiling of 36MB, while the others top out at 8MB of RAM. To many this may sound like semiconductor overkill, but we envision complex database and communication applications that may need this much memory.

As far as software goes, each system also goes its own way. For example, the Cassiopeia comes with a financial calculator that can help you with bond interest or mortgage payments, while the MobilePro adds a CD-ROM–based set of utilities for synchronizing data with a desktop or mobile PC. The Velo 1 comes with both Pocket Quicken home finance software and a handy voice memo application for storing and organizing recorded sound bites.

NECK-AND-NECK

Despite being based on a range of different processors, these three first-generation Windows CE units didn't reveal huge performance differences. Nevertheless, the Velo 1 was a consistent overachiever. The Cassiopeia uses the Hitachi SH-3 architecture, while the MobilePro and Velo 1 are based on NEC's V-series and the MIPS R-3900 series, respectively. Under a variety of testing conditions, they all felt snappy and quick to respond to input from either the pen or keyboard. They're all instant-on devices, which removes the tedium of waiting for Windows to load before you get

PERFORMANCE TESTS

Windows CE Systems

The winner across the board was the Philips Velo 1, which was the fastest of the three Windows CE systems on our trio of timed tasks. The Casio Cassiopeia A-10 and NEC MobilePro 400 were roughly equivalent, although the MobilePro had a slight advantage.

Lower scores represent better performance.
Bold type denotes first place.

	Spell-Check Seconds	Recalculation Seconds	Open File Seconds
Casio Cassiopeia A-10	19	4	3
NEC MobilePro 400	18	3	3
Philips Velo 1	**14**	**2**	**2**

HOW WE TESTED
We timed these Windows CE systems performing three typical tasks. In Pocket Word, we spell-checked a 35K Word file that contained 12 errors. In Pocket Excel, we performed 8 recalculations in a 25K file, and we timed how long it took to open a typical Excel file.

down to work; you just open the case and start typing.

In quantitative and qualitative tests, the Velo 1 was the pocket speed demon of the bunch. Common tasks, such as opening and closing applications, are noticeably faster on the Velo 1, but with a second or two separating the best and the worst performers, it wasn't exactly a slam dunk.

These first three HPCs are only a sneak preview of Windows CE systems to come. Expect to see at least another four in the coming months from PC vendors, including Hewlett-Packard and Compaq (see the sidebar "Windows of Opportunity"). And despite all this HPC hype, the Psion 3c is fully competitive with this wave of handheld PCs (see the sidebar "Psion: Past, Present, and *Maybe* Future of the PDA").

HAND-OFF

Which one is right for you depends on your palmtop ambitions. If you're looking for nothing more than an electronic address book of contacts and schedulers, think low and get one of the many organizers that cost about $100. But if you're seeking the power and flexibility to write, work through spreadsheets, and even nose around on the Web without being tied down by a traditional PC, then either the Cassiopeia or the MobilePro should suffice.

If you want your pocket PC to be a valued travel companion and workhorse-on-the-go, look no further than the Velo 1, which was the fastest of the trio, the only one to include a modem, and the most elegant of the three systems.

Casio Inc.

Cassiopeia A-10

Despite its celestial name, Casio's $499 Cassiopeia A-10 is a down-to-earth and economical PDA. The Cassiopeia tries to differentiate itself from the growing crowd both by price and by offering unique software extras, but it was the most basic and least functional of the three devices we looked at.

The Cassiopeia measures 6.8- by 3.6- by 1-inch, making it the smallest of the devices we tested—if only by a hair. Ready for

COUNTERPOINT

Psion: Past, Present, and *Maybe* Future of the PDA

What's the big deal with these Windows CE systems, Sebastian? Sure, they set a level playing field for manufacturers and software vendors to compete on, but just about every Windows CE innovation is old hat for the Psion 3 series of PDAs.

Powered by an 7.7-MHz NEC V30 processor, the Psion 3c's 2MB of memory goes a long way because its operating system is a memory miser. All items are displayed on the unit's 480- by 160-pixel monochrome screen, which can show 80 characters on each of its 25 lines. At 6.5 by 3.3 by 1 inches, the Psion 3c is smaller than the Windows CE systems reviewed here, and it tips the scales at just 10 ounces. In addition, its textured plastics and industrial design set a world standard.

Yes, the Psion 3c uses proprietary applications, as opposed to CE's Windows-like open architecture. But there are hundreds of Psion programs, ranging from screen savers to personal finance and database managers. Microsoft and Symantec have even ported the Automap digital atlas and ACT, respectively, for the Psion. The Psion 3c comes with a word processor (compatible with Word files), a spreadsheet (compatible with Lotus 1-2-3 and Excel files), a database (that uses native .DBF files), a scheduler, a file manager, a calculator, a note pad, a sound recorder and editor, and a world time converter. There's even a card game called Patience, but I never figured out how to play it.

POCKET PC: *The Psion 3c packs a multitude of applications into its pocketable case.*

PDAs are as personal as toothpaste, and over the years I keep coming back to Psion. Sure there's no stylus or pointer, but navigation within its simple interface is so straightforward that you really don't need them. And there's no pen to lose. The excellent PsiWin transfer and Agenda synchronization utilities ease moving data between the PC and the Psion. It takes about 10 seconds to move a 25K Word file into the Psion 3c using the serial connection running at its full speed of 57 Kbps.

The Psion 3C is far from perfect; it needs to continue to evolve. The system's upgrade cards are not standard, the external modem is bulky and slow, and a slightly larger screen would make it easier to read small type. But within the constraints of fitting into a jacket's breast pocket, the Psion 3C is a step ahead.

At about $550 complete with software—about the same price as stripped Windows CE systems—the fully equipped Psion 3c is a bargain And it remains my favorite for a pocketful of data.—*Brian Nadel*

Psion 3c. Street price: $550. Psion Inc., Concord, MA; 508-371-0310; fax, 508-371-9611; www.psion.com. *Circle 412 on reader service card.*

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SUMMARY OF FEATURES

Windows CE Systems: Side by Side

Products listed in alphabetical order	Casio Cassiopeia A-10	NEC MobilePro 400	Philips Velo 1 (PC MAGAZINE EDITORS' CHOICE)
List price	$499	$649	$699
Dimensions (HWD, in inches)	1.0 x 6.8 x 3.6	1.0 x 6.9 x 3.7	1.0 x 6.8 x 3.7
Weight (ounces)	13	13	13
Expansion options	One Type II PC Card	One Type II PC Card	Two Mini Cards, One Type II PC Card with V-Module cradle
Processor/Speed	Hitachi 32-bit SH-3/60 MHz	X NEC 32-bit V 4101/33 MHz	MIPS 32-bit R 3900/36.6 MHz
RAM/ROM	2MB, 4MB	4MB, 8MB	4MB, 8MB
Built-in modem	None	None	V.32bis, 19.2-Kbps capable

a day on the job, it weighs 13 ounces with its pair of AA batteries in place but without its AC adapter. The device can accept a Type II PC Card, and it has a serial port and an IrDA wireless infrared port.

Like the MobilePro, the Cassiopeia comes in two memory configurations. The A-10 model we looked at came equipped with 2MB of RAM, but we suggest you consider the A-11 model, which comes with 4MB of RAM and costs about $100 more. Both the A-10 and A-11 units come with 4MB of ROM, compared to 8MB for both the MobilePro and Velo 1. This extra space for storing BIOS commands, operating systems, and applications will probably come in handy as this species evolves. The Cassiopeia's 0.5-inch speaker to the left of its display was barely adequate for playing .WAV files.

Based on a Hitachi SH-3 RISC processor, the Cassiopeia performed our recalculation on a 25K Pocket Excel spreadsheet in 4 seconds, which was slightly slower than the MobilePro and Velo 1—3 and 2 seconds, respectively. On our spell-check test on a 35K Pocket Word file with 12 errors, the Cassiopeia again took up the rear at 19 seconds. Although it is clearly the laggard of these three devices, the Cassiopeia did quite well when you consider that it has less memory than the other two.

The Cassiopeia comes with several unique business applications designed to allow fax and wireless e-mail communications, but you're on your own as to which modem to use it with. For business users shopping in this price range, the inclusion of a high-end financial calculator alone may make the Cassiopeia the best choice.

Casio Cassiopeia A-10. List price: With 2MB RAM, $499. Casio Inc., Dover, NJ; 888-204-7765; fax, 201-361-3819; www.casio.com. *Circle 413 on reader service card.*

NEC Electronics

MobilePro 400

NEC's MobilePro 400 is a fully functional Windows CE system that is middle of the road in all respects. It's positioned for cost-conscious users and lacks the expandability, hardware extras, and unique software offerings found in Philips's Velo 1 system. But considering its price tag, the MobilePro is a good value.

Measuring 6.9- by 3.7- by 1-inch and weighing 13 ounces without its AC adapter but with a pair of AA batteries in place, the MobilePro is slightly larger than the Cassiopeia and the Velo 1. Its connections with the outside world include one Type II PC Card slot, one serial port, and one IrDA infrared wireless port.

The MobilePro comes in two flavors: a MobilePro 200 version with 2MB of RAM and the 4MB MobilePro 400 we evaluated. Both versions come with 8MB of ROM, which is equal to that of the Velo 1 and twice that of the Cassiopeia.

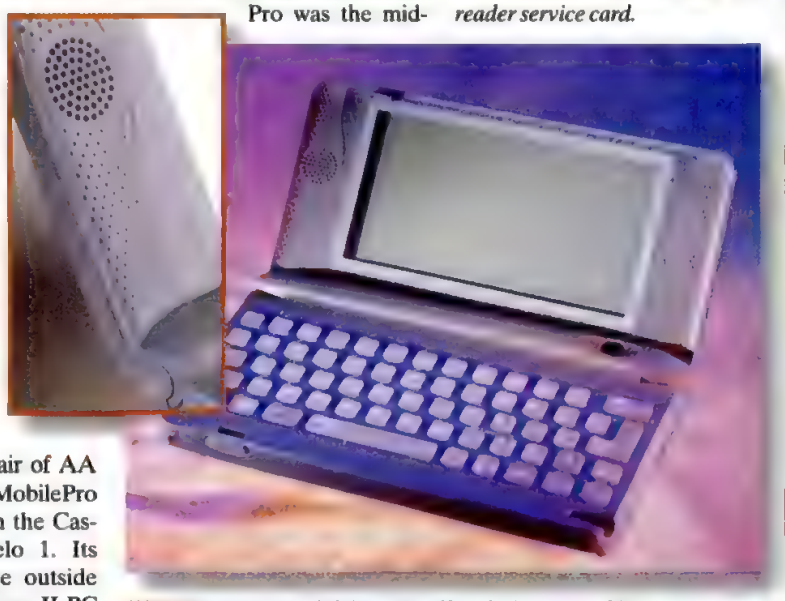
Like the Cassiopeia, the MobilePro has a barely passable 0.5-inch speaker on the left side of the display panel for sound effects. The MobilePro has a docking unit called the MobilePro Cradle, which facilitates easy file transfers to a PC; just snap the unit into the cradle and run the included software.

The MobilePro is based on a NEC V4101 CPU running at 33 MHz. On our tests, the MobilePro was the mid-range performer of this Windows CE trio. On its Pocket Excel recalculation and Pocket Word spell check, the MobilePro was nestled between the Cassiopeia at the low end and the Velo 1 at the high end.

In addition to the standard software offerings in Windows CE—including Pocket Word, Pocket Excel, Internet Explorer 2.0, and several PIM modules—the MobilePro comes with a CD-ROM–based set of utilities called Windows CE Manager for synchronizing data between the PDA and a desktop PC. These applications made it easier to keep your data up to date and in the right place.

At $649, the 4MB MobilePro emphasizes the synchronization of data with a desktop or notebook PC and could very well be the value compromise between the power and flexibility of the Velo 1 and the economy of the Cassiopeia. It's the Windows CE PDA for those who need to live on a strict budget but don't want to compromise.

MobilePro 400. List price: With 4MB RAM, $649. NEC Electronics, Computer Systems Division, Mountain View, CA; 800-632-4525, 415-528-6000; www.nec.com. *Circle 414 on reader service card.*



MOBILITY: *NEC's MobilePro 400 offers the best mix of file-synchronization software for keeping your data in all the right places.*

Award Winning Products

December 1996
Boot Magazine
RE: Nimantics Orion 166

November 1996
Laptop Buyers Guide
RE: Nimantics NX-Lite 133

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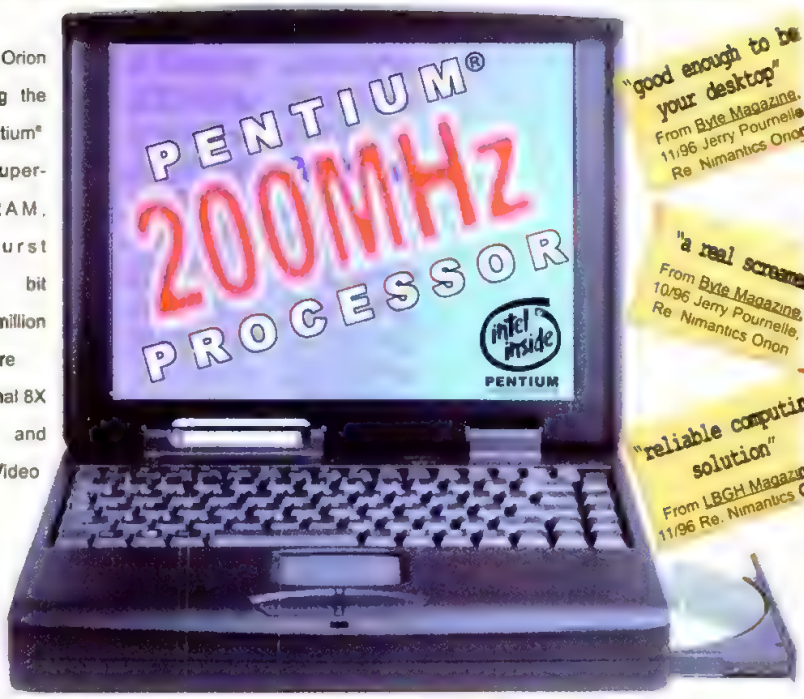

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Velo 1

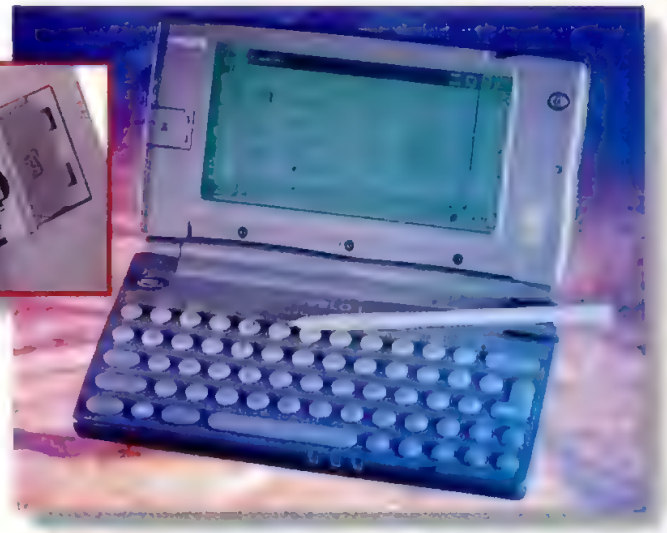
PC MAGAZINE EDITORS' CHOICE

Positioned to appeal to enterprise users who want high-end features and are willing to pay a little extra, the Velo 1 costs $699. But it's well worth the price because of its included array of goodies—from a built-in modem to its synchronization cradle—that are aimed at power-hungry users.

Ready for the road, the Velo 1 measures 6.8- by 3.7- by 1-inch and weighs 13 ounces without its AC adapter but with two AA batteries installed. Like the MobilePro, the Velo 1 comes with 8MB of ROM; the Cassiopeia comes with half as much. The oddball of the group, the Velo 1 uses a DRAM Mini Card slot for memory expansion of up to 36MB; there's also a flash memory Mini Card slot. Unlike the other two PDAs, the Velo 1 itself doesn't have a PC Card slot, and for larger-scale expansion you need to use the external Type II PC Card bay. The system does have a serial port and an IrDA infrared port.

The sculpted Velo 1 has easily the most refined design of the bunch. To the left of its display is a pop-out toggle for an RJ-11 phone jack, making it the only one of the three to be communications-ready out of the box; the others require a PC Card modem to make a connection. In addition, to the right of the display is a small button, which when pushed lights the screen for added visibility. The downside of this communications equation is that with the modem operating, battery life is decimated, so plan on bringing the AC adapter along with you.

Built around a MIPS R-3900 32-bit processor running at 36.6 MHz, the Velo 1 placed first on all three of our performance tests. On our recalculation tests with a 25K Pocket Excel spreadsheet, the spell-checking of a Pocket Word file, and the opening of a file, the Velo 1 was always at least a second ahead of the other two.



HAND POWER: *Philips's Velo 1 puts it all together with exceptional performance, a built-in modem (inset), and a sleek design.*

The Velo 1 unit we looked at came with its own mix of software in addition to the standard Windows CE fare. The Velo 1 has a handy set of application-switching buttons for popping up Internet Explorer, Excel, or any of several other applications. In addition, there's a copy of Pocket Quicken for running the family finance numbers while you're on the road.

The most interesting program is the Velo 1's Voice Memo application, which allows the user to record brief voice memos via a built-in microphone and store them in Windows Explorer–like tree fashion. As with the other two, the Velo 1's on-board speaker was barely adequate.

Positioned as the power-user's hand-held computer, the Velo 1's $699 price includes a docking station and built-in modem. The system is clearly the fastest, most expandable, and most feature-rich unit we tested. Compared to the Cassiopeia and MobilePro, the Velo 1 looks and feels like a second-generation system, and it is our choice for taking your data and favorite applications on the road.

Velo 1. List price: With 4MB RAM unit and docking station, $699. Philips Mobile Computing Group, Sunnyvale, CA; 888-367-8356, 408-523-2800; www.velo.com. *Circle 415 on reader service card.*

Windows of Opportunity

With the first Windows CE systems out and on store shelves for the holiday season, several others are on deck, awaiting release this spring and summer. In contrast to the initial pocket rockets, the next three systems may actually gain from waiting for some of the first generation kinks to be worked out of Windows CE. And rather than being generic PDAs, these will each have an individual focus.

▪ Hewlett Packard's as-yet-unnamed system will take graphics and display a step further with what will likely be the largest display for a Windows CE system. Its 640-by-420 screen is 1.3 inches wider than the others. And it can show 28 percent more information than the more prevalent 480-by-240 screen. Look for an intriguing GSM-based hybrid cellular phone/PDA that will be a Europe-only device.

▪ Hitachi is emphasizing computing power with an HPC system that will be powered by the company's own 32-bit SuperH RISC processor.

▪ The last to arrive at the Windows CE party will probably be Compaq. Its system will be an update of Casio's Cassiopeia and will focus on wireless connectivity and remote e-mail coverage.

With a new hand-held operating system and at least seven new ultra-portable systems to choose from, the universe of PDAs is expanding rapidly. The question is whether this market will continue to expand, level off, or be followed by an implosion.—*Brian Nadel*

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NOTEBOOK PCs

A Hard Knocks Notebook

The Panasonic CF-25 is the sport utility vehicle of notebook PCs.—By John Morris

While other notebook makers have been concentrating on thinner, lighter machines, Panasonic has been designing the $4,050 CF-25—the Rambo of portable PCs.

At first glance, the CF-25 looks much like any other notebook, although, at 2.3 by 11.7 by 9.3 inches (HWD), it's slightly larger than most. Grab the system by its handle and you immediately feel the difference: The CF-25 is completely encased in a rigid magnesium alloy that makes it seem so solid and durable that you'll feel confident lugging it around without a case.

For shock protection, Panasonic wrapped the 1.35GB hard disk and floppy drive in a high-tech vibration-damping material. And if you accidentally dump a drink on the keyboard, just drain it off and keep going; the CF-25's sealed keyboard and touch pad, and rubber-sealed ports are designed to withstand a hard rainfall and the occasional cup of coffee.

Surprisingly, the 7.8-pound CF-25 actually weighs less than its presentation-class sibling, the 9.5-pound CF-62; the CF-25's total travel weight is 8.6 pounds.

The 10.4-inch backlit active-matrix display is capable of displaying 65,000 colors at 800-by-600 resolution. Function keys control brightness, a battery monitor, and the volume of the watertight speakers, which are integrated in the display panel.

SHAKE, RATTLE, AND ROLL: *The Panasonic CF-25 comes in its own metal carrying case.*

Though not designed to be a presentation-class notebook, the CF-25 can do multimedia. It ships with 16-bit Sound Blaster–compatible audio, and you can swap the 3.5-inch floppy drive for one of Panasonic's modular Multimedia Pocket accessories—such as the $399 6X CD-ROM drive.

One unique feature of the CF-25 is its three-bay PC Card slot, which accommodates either three Type II cards or one Type III and one Type II card. We tested the CF-25 with a modem, a cellular radio, and a network card. The lower slot is Zoomed Video Port–ready for MPEG video. To transfer files and send print jobs without being tied down, the CF-25 has an IrDA port and includes a copy of Puma Technologies' TranXit, Version 3.0.

The Pentium/133 system we tested had 16MB of EDO RAM, and a 1.3GB hard disk but no external cache. Its best score was on our ZD Business Disk WinMark 97 test, where it was 13 percent faster than the average P/133 system. (See "Affordable, Portable Notebook PCs" in this issue.)

A combination of sturdy features and a reasonable form factor, along with able performance, make the Panasonic CF-25 a notebook that keeps on going.

Panasonic CF-25. Street price: With Pentium/133 CPU, 16MB RAM, 1.35GB hard disk, 10.4-inch active-matrix display, $4,050. Panasonic Personal Computer Co., Secaucus, NJ; 800-662-3537, 201-271-3182; www.panasonic.com. *Circle 408 on reader service card.*

PDAs

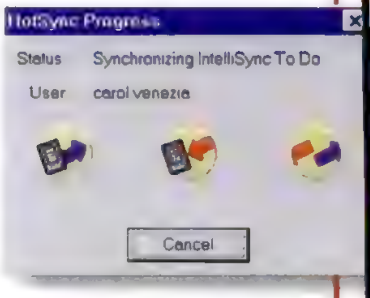
Making the Pilot Fly

IntelliSync makes short work of synchronizing data from just about any PIM to your Pilot.—By Carol Venezia

In case you love your Pilot but hate its limited import/export feature, Puma Technology's $70 IntelliSync for Pilot will keep you in sync.

Although you can import information from a PIM to the Pilot through the Pilot Desktop, it's a multiple-step process that's limited. IntelliSync works directly with Pilot's HotSync utility to provide seamless updates with your favorite PIM—including Day-Timer Organizer, ECCO 3.03, Lotus Organizer, Schedule+ 7.0, and Sidekick 95. IntelliSync also adds Date Book and to-do list support to the mix.

IntelliSync is highly flexible and simple and painless to use. All you do is press the HotSync button and you're done. IntelliSync flawlessly transferred a 1,000-contact ECCO database between the Pilot and the PC. The beauty of IntelliSync is that it not only works with numerous contact managers but synchronizes each in succession during the same HotSync session. PIM junkies, then, don't have to give up one PIM for another in order to sync up with Pilot.



SYNCHRONICITY: *IntelliSync can help keep your files straight.*

The only drawback to IntelliSync for Pilot is that you'll have no more excuses for being disorganized.

IntelliSync for Pilot. Street price: $70. Requires: 8MB RAM, 5MB hard disk space, Microsoft Windows 3.x, Windows 95, or Windows NT. Puma Technology Inc., San Jose, CA; 800-774-7862, 408-321-7650; www.pumatech.com. *Circle 409 on reader service card.*

BENCHMARK TESTS

Panasonic CF-25

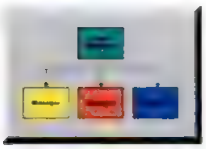
Despite an impressive showing on our Business Disk WinMark 97 benchmark tests, the Panasonic CF-25's other scores lagged behind the average of the Pentium/133 notebooks reviewed in this issue's roundup.

To gauge the performance of this notebook under Microsoft Windows 95, we used ZD Winstone 97, ZD WinBench 97, and ZD BatteryMark. The Panasonic CF-25 was equipped with a 1.3GB hard disk and had 16MB of RAM.

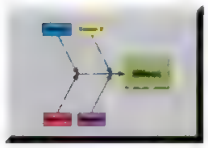
Higher scores represent better performance.	ZD Business Winstone 97 Score	ZD Business Graphics WinMark 97 Score	ZD Business Disk WinMark 97 Thousands of Bps	ZD CPUmark32 Score	ZD BatteryMark Hours.minutes
Panasonic CF-25	20	22.9	425	172	1:46
Average Pentium/133 notebook*	23	32.5	377	223	2:04

* Based on "Affordable, Portable Notebook PCs" in this issue.

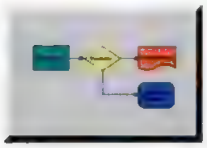
PHOTOGRAPH BY THOM O'CONNOR



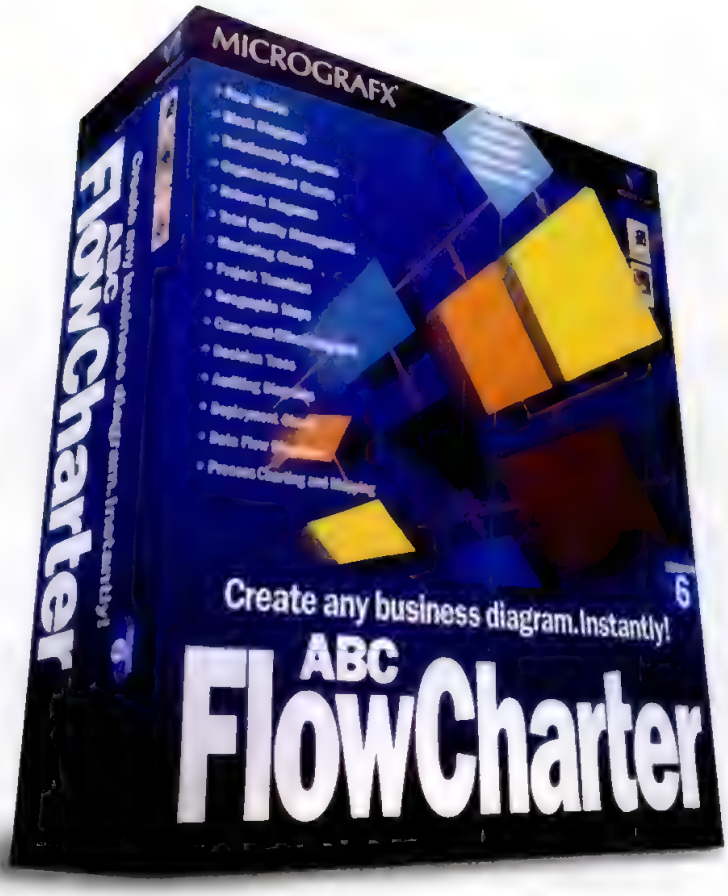
Human resource tools like organization charts and relationship diagrams

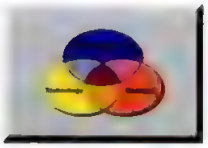


Management support diagrams like cause & effect decision trees and timelines



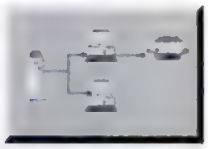
Business process re-engineering diagrams like flow charts and data flow diagrams





Marketing tools like venn diagrams, targets, pyramids and geographic diagrams

Total quality management diagrams like process charts and maps



IT and software design tools like network diagrams and object oriented design diagrams

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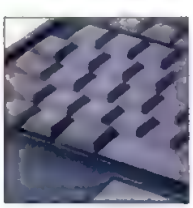

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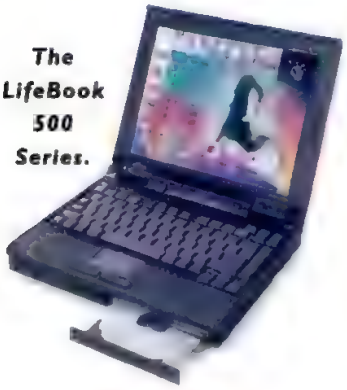
A NOTEBOOK WITH SOME PRETTY COOL TOUCHES.



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② **A PALM REST for comfort. A newly designed keyboard for convenience—like giving those darn arrow keys some space.**

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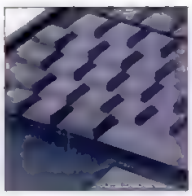

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First Looks

DATA ANALYSIS

A PC Crystal Ball

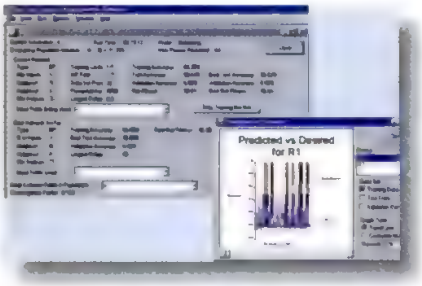
NeuroGenetic Optimizer puts the power of neural networks within reach.—By Neil Rubenking

BioComp Systems' NeuroGenetic Optimizer, Version 2.1 (NGO) is a powerful data analysis tool with a wide variety of applications. It can take data consisting of one or more input variables and one or more output variables and generate a neural network that learns the patterns and relationships between them. You can then pass a new set of inputs to the trained neural network to forecast future trends.

Neural networks can be used for a variety of purposes including stock-market prediction, automated medical diagnosis, and detection of credit-card fraud. NGO can calculate the expected output, discern whether a particular condition exists, determine what category the inputs define, or predict a future value. The cost of NGO depends on the number of input variables you intend to use, ranging from $195 for 16 variables to $4,195 for 512 variables.

Neural network technology has been around since the 1940s, but creating a neural network traditionally required a major investment of time and study. NGO eliminates this hurdle by creating a population of networks configured in different ways. It trains all of the networks using the supplied data. Then it tests their fitness and retains only the best networks, replacing the rest with "genetically" modified variations of those selected.

As this process is repeated, the system arrives at a network that best represents the data. Be warned: A complex analysis project using this evolutionary process could take hours or even days to complete. Fortunately, NGO runs cleanly in the background, has the ability to halt and restart, and can even save its progress periodically.



DARWINIAN DATA: *NGO evolves better neural networks by discarding the least fit networks and retaining the best ones.*

NGO's Setup Wizard eases the process of starting a new project, from importing the data to setting appropriate neural, genetic, and system options. NGO provides a number of different views of the ongoing development process, including a graph comparing the predicted and desired output variables and a status display.

Once NGO has produced a network that fits the data, you need a separate product, such as BioComp's free Predictor or its $195 Penney add-in for Microsoft Excel, to view or use the resulting network. For serious analytical work, BioComp's $6,000-and-up Enterprise Modeling Server (EMS) automates testing against new data.

NGO allows the small-business owner to tap the power of this sophisticated technology—without having a degree in mathematics.

NeuroGenetic Optimizer, Version 2.1. List price: 16 input variables, $195. Requires: 6MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later, Windows 95, or Windows NT. BioComp Systems Inc., Redmond, WA; 800-716-6770, 206-869-6770; www.bio-comp.com. *Circle 405 on reader service card.*

PRESENTATION SOFTWARE

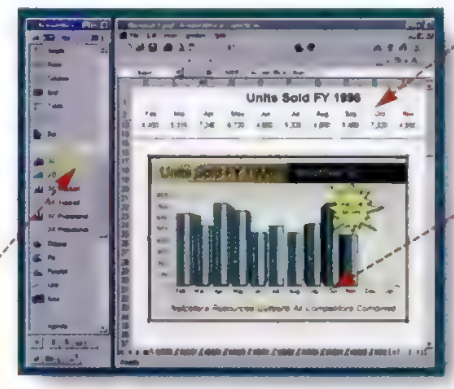
Instant Graphical Appeal

SPC's ActiveOffice doesn't try to beat Office but improves it.—By Scot Finnie

Software Publishing Corp.'s $50 ActiveOffice 1.0 is a highly developed add-on for Microsoft's Office 95 or 97 that provides over 100 layouts that let you quickly improve the graphical appeal of Microsoft Word, Excel, PowerPoint, and Exchange documents. As with the SPC's WordPower program, you choose from a wide selection of layouts, designs, color schemes, and textures to give your documents a splash of style.

Choose from the ActiveOffice list of preformatted styles.

ActiveOffice is a discrete program but one that cooperates with Office, and relies almost entirely on OLE 2.0 to shepherd files and fragments. All you do is highlight the appropriate data in your Office document and double-click on a layout in the ActiveOffice program window. To walk through the available layouts, designs, color schemes, and textures using your data as a model, you click individual settings in the ActiveOffice program window and view the results back in your document.



The original document remains in view and active.

Charting options, including highlighting devices, are expanded greatly.

Style Maven: *ActiveOffice lets you work in Office, but adds a slew of options for sprucing up your documents.*

Since it relies on OLE, ActiveOffice isn't lightning fast, especially if you're working with a complex document or a PC that is less-than state of the art. But the product can help with the little things such as tastefully matching color schemes. It also looks and acts the same, whether you're working with PowerPoint or Exchange. That's a powerful advantage because it lets you focus on your data rather than on the tool that you're manipulating it with.

Spruce up your mundane Microsoft Office documents with ActiveOffice.

SPC ActiveOffice 1.0 for Microsoft Office 95/97. Street price: $50. Requires: 8MB RAM, 4MB hard disk space, Microsoft Windows 95 or Windows NT 4.0, Microsoft Office 95 or Office 97. Software Publishing Corporation, San Jose, CA; 800-336-8360; www.spco.com. *Circle 403 on reader service card.*

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56i	15" FST (13.6" VIS)	.28mm dot	1024x768 @ 80 Hz NI
56m*	15" FST (13.6" VIS)	.28mm dot	1024x768 @ 80 Hz NI

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INTERNET

Cellular Communications Center

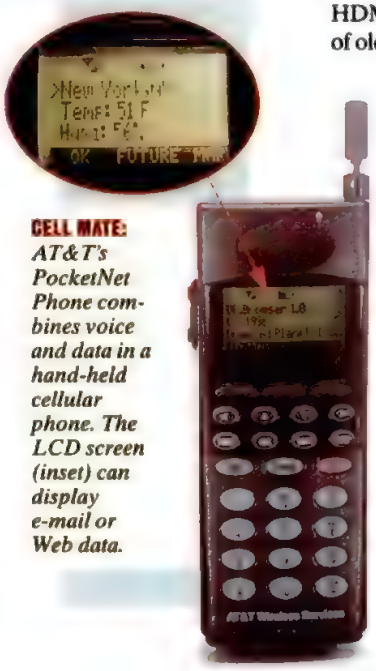
Tired of carrying a cellular phone and a wireless data modem, then getting a bill for each? AT&T's PocketNet Phone puts it all together.—By Brian Nadel

An all-in-one cellular voice and data mobile communications center, the $500 AT&T PocketNet Phone is for those who value staying connected wherever the job takes them. Capable of pulling information off the World Wide Web, sending and receiving e-mail, and eventually transmitting digital files, the PocketNet Phone fulfills its basic mission of integrating all things cellular, but its bulk and weight may turn off many nomadic workers.

The PocketNet Phone is a 600-milliwatt cellular phone made by PCSI, a division of Cirrus Logic, that can also tap into the CDPD (cellular digital packet data) network. Expect to see similar combo cellular devices from Mitsubishi, Samsung, and other manufacturers soon. To the Internet, the IP-ready PocketNet Phone looks like any other connected client.

The PocketNet Phone runs on nickel hydride batteries, which come in two sizes. The 0.8-inch-thick cell was good for about 40 minutes of on-and-off-use, while the 0.4-inch-thick cell was good for about 20 minutes. The charger can recharge a battery pack in about an hour. The phone's keypad has a convenient backlight, which illuminates the system's keys; the light shuts itself off after about 15 seconds without user interaction. At 6 by 2.3 by 1 inches and weighing 6.1 ounces (11.6 ounces with the thin battery in place), the PocketNet Phone is significantly larger and heavier than most cellular phones.

For viewing data, you're limited to the PocketNet Phone's three-line, monochrome screen, which can display 20 characters on a line. You can use the display to read e-mail, browse and gather information from the Web, and check the PocketNet Phone's status. There are icons for battery life and signal strength.



CELL MATE: *AT&T's PocketNet Phone combines voice and data in a hand-held cellular phone. The LCD screen (inset) can display e-mail or Web data.*

PHOTOGRAPHY BY THOM O'CONNOR

WEB PHONE

In addition to supporting the Amps circuit–switched voice network for conversations, it can transfer data over the emerging CDPD network and work with the Web. For transmitting data, the phone has a V.32bis wireless modem that is capable of a maximum throughput of 19.2 Kbps via CDPD. If a message is waiting for you when you turn on your phone, a small envelope icon appears on screen.

Next to nothing is stored locally on the PocketNet Phone. Incoming messages reside on a secure server along with an address book and any other personal items. And you can fax any e-mail message or Web document, which eases the feeling of digital claustrophobia.

By far the most interesting facet of this cellular phone is its unique ability to download and view Web pages in the data-light HDML format. HDML is a mix of old and new formats that emphasizes efficient use of data above all else. Ironically, HDML can seem like a step backward to the days of dumb terminals, because it strips the Web to the bone: There are no graphics and no multimedia elements, just character-based information.

At this point, a limited yet eclectic assortment of information resources are available via HDML, including weather reports for some major cities, stock quotes, sports scores, and a U.S. white pages phone directory that includes an auto-dialer. But just imagine what could be done with access to corporate price lists, workgroup calendars, warehouse inventory, and other information and you begin to see the potential of the PocketNet Phone.

The price you pay for complete mobility is that documents can be awkward and time-consuming to read and navigate on the PocketNet Phone, even after several months of use. This is due to the phone's reliance on a tiny screen, arrow keys, and a touch-tone phone keypad. We found typing even the most basic e-mail message to be a lesson in patience.

One feature that helps minimize the problem is that HDML allows you to embed multiple-choice responses in an e-mail or Web site. For example, we received an e-mail message that contained the question, "Lunch today?" and offered three separate suggested responses with times and places. This feature allowed us to reply with a single keystroke.

All told, the PocketNet Phone works quite nicely as an integrated communications portal. Information moves to and from it efficiently and is displayed in a usable albeit spare manner.

THE MISSING LINK

Currently, the PocketNet Phone lacks the key cable needed to connect it to your notebook so that you can use the device as a cellular modem. The cable should be available when the PocketNet Phone goes into widespread distribution later this year. When it can tap into the CDPD network for data transfers, the PocketNet will truly be a phone without peer.

AT&T Wireless Services learned from the mistakes of its predecessors, particularly the ill-fated Bell South Simon (First Looks, October 25, 1994), which was introduced as equal parts computer and cellular phone. The PocketNet Phone is more like a phone with some rudimentary yet realistic computing abilities. It won't store your day's appointments or notes locally, but you can browse through a personal address book kept on a remote server.

For many, the most enticing aspect of the PocketNet Phone is that AT&T goes where no cellular provider has gone before: Both voice and data cellular service charges are integrated into a single bill.

AT&T PocketNet Phone. Street price: $500. Requires: Cellular account. AT&T Wireless Services Inc., Kirkland, WA; 800-552-3373; www.airdata.com. *Circle 404 on reader service card.*

WIRELESS COMMUNICATIONS

CDPD Made Easy

A cellular radio and 33.6-Kbps modem make AirCard the king of the road of PC communications—By John Morris

Sierra Wireless's AirCard is a $900 two-card combo that promises to meet all your wireless communications needs, whether you're sitting in a hotel suite or stuck in traffic.

AirCard consists of two Type II PC Cards—the AirCard PCMCIA Cellular Radio and the AirCard PCMCIA Modem—that use the CDPD network to send and receive data over the existing cellular voice system. A Microsoft Windows 95 utility, called Watcher, allows you to switch among wireline, circuit-switched cellular, and CDPD modes; there's also a signal-strength monitor and channel selection program.

Windows 95 recognized the cards and prompted us for the installation disks. The two cards are linked by a tiny block, and the cellular transceiver uses an unobtrusive antenna.

Unlike circuit-switched voice calls, which lock onto a channel for the duration of the call, CDPD sends data in 2K packets to the cellular base station for distribution over the traditional phone system. CDPD technology is currently limited to 19.2-Kbps throughput but is perfect for working with battery-powered notebooks, because data is transferred in short bursts.

IN THE CARDS: *The AirCard's Watcher utility gives you the details of your cellular connection.*

According to the CDPD Forum (*www.cdpd.org*), CDPD service is now available in 97 major U.S. markets. We tested the AirCard in the New York metropolitan area using Bell Atlantic NYNEX's AirBridge CDPD service. Unlike voice cellular charges, which are based on call duration, CDPD fees are based on the amount of data transferred. In addition to monthly service plans (from $14.95 for low usage to $89.95 for high usage), it costs from 4 to 15 cents a kilobyte to use the CDPD network; activation fees range from $35 to $50.

When you're near a phone outlet, the V.34 modem card can operate as a 33.6-Kbps data and 14.4-Kbps fax modem. The AirCard modem also supports voice telephony features on some upcoming Compaq notebooks.

Since CDPD is based on TCP/IP, any application that works over the Internet will work with the AirCard. On our tests, it worked flawlessly with CompuServe 3.0 and Internet Explorer. Whether inside or outside, we got clear connections and experienced data flow somewhere between 9.6 and 14.4 Kbps. For example, it took nearly 7 minutes to download a 414K file via CDPD, while with a 14.4-Kbps line modem it took 5 minutes, 25 seconds. We tested the AirCard on a Panasonic CF-25 notebook with a Pentium/133 processor and 16MB of RAM.

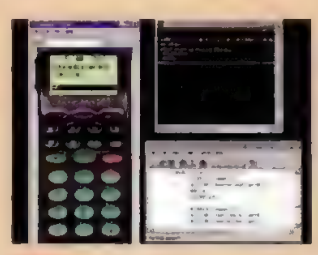
The AirCard provides an arsenal of communications options in a convenient plug-and-play package. The only drawback is that you'll never again have an excuse for being incommunicado.

AirCard. Street price: $900. Requires: 2 Type II PC Card slots, Microsoft Windows 95. Sierra Wireless Inc., Richmond, British Columbia, Canada; 604-231-1100; www.sierrawireless.com. *Circle 405 on reader service card.*

The Web Without the Wires

A new development platform from Unwired Planet is making it easier for pagers, cellular phones, and PDAs to find their way onto the Internet. The UP.Link Platform is a package of services and development tools which brings the Web to hand-held devices via HDML.

Obviously, with the minimal interface available, hand-held devices require a different way of thinking about Internet content and design. But it's also clear that there is a lot of content—almost any directory or listing—that could benefit from repackaging into this small, efficient format.



PHONE-Y: *The UP.Phones software emulation tool lets you test HDML-based Web applications.*

In contrast to HTML, HDML packages Internet content in *decks*, which can contain multiple *cards* or individual screens. Once the deck is loaded (it can be up to 1,492 bytes), the user can navigate between cards, of which there are three kinds. *Display cards* show data to the user (such as stock quotes); *entry cards* let the user type in a string value (for instance, a PIN to validate a transaction); and *choice cards* let the user navigate between cards using the special function keys on a hand-held device.

Unwired Planet (*www.uplanet.com*) serves as a clearinghouse for information requests from the AT&T PocketNet Phone, and from other such devices. To see how the system works, we wrote an application for streaming headlines from our Web site into the PocketNet Phone or into a simulator via UP.Link and HDML. To try it, point your browser to our InternetUser site (*www.pcmag.com/iu*) and follow the instructions to download the SDK.

For developers, Unwired Planet's SDK also includes descriptions of HDML, and built-in C++ classes and Perl scripts that help you work with HTTP content on the server through CGI scripts. At press time, Unwired Planet also announced plans to bundle its HDML engine and phone simulator with Allaire's popular Cold Fusion and The Sapphire Group's PageBlazer. These integrated development environments will make it easier to extend applications to HDML.—*By Rich Dragan*

WEB SITES

Web Statistics 101

Whether you want to know how many people are alive or how many are online, the Net can help.—By Mary Paulson

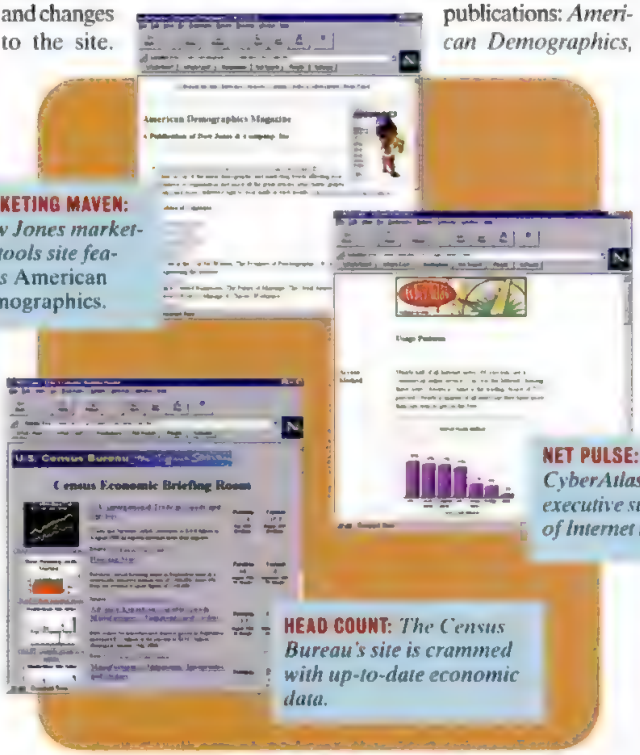
Just how useful the Internet can be remains open to debate. But one thing we can all agree on is that the Net is a font of information resources—you just have to know where to look. These resources include demographic information, which can be critical to businesses and marketing professionals.

For information on the general population and economic data, some of the most useful sites belong to the U.S. government. At them, you'll find a surprising breadth and depth of information previously available only by ordering government documents.

One of the most popular topics online is the demographics of the Net itself. How many people are using it for what purposes? To help you sort it all out, we suggest some places to start.

Perhaps the largest source of social, demographic, and economic data is the **U.S. Census Bureau** (*www.census.gov*). To help you cope with the massive amount of information, this site's builders have created an online user manual. In addition to population statistics, the site includes such resources as news reports, a set of data-access tools, a searchable subject index, and an array of Census Bureau publications you can download in .PDF format. The news section includes press releases, the latest economic indicators, statistical briefs on public policy issues, and summaries of demographic surveys.

Unique to this site are such data-access tools as the MABLE/Geographic Correspondence engine, Census Bureau Map Statistics, and Data Ferret (Federal Electronic Research and Review Extraction Tool), as well as downloadable software. If this site becomes a mainstay of your research, subscribe to the I-Net Bulletins, a mailing list that keeps you posted about new products, services, and changes to the site.



MARKETING MAVEN: *Dow Jones marketing tools site features* American Demographics.

NET PULSE: *CyberAtlas is an executive summary of Internet trends.*

HEAD COUNT: *The Census Bureau's site is crammed with up-to-date economic data.*

The **Bureau of Labor Statistics** (*www.bls.gov*), an agency within the U.S. Department of Labor, is another great governmental resource. Here you'll find tables and graphs on the labor force, unemployment, productivity, and consumer/producer price indexes. There are surveys on prices, living conditions, and technology. This site also features international price indexes and tallies of foreign direct investment.

You can perform keyword searches across all the bureau's Web pages. Research papers by Bureau of Labor Statistics authors are available for downloading, searching, and mail order. The site includes links to other federal agencies, such as the National Center for Health Statistics (*www.cdc.gov/nchswww/nchshome.htm*) and the National Center for Education Statistics (*www.ed.gov/nces1/*).

American Demographics and Marketing Tools has a Dow Jones site for business people, (*www.marketingtools.com*) that includes access to three major publications: *American Demographics, Marketing Tools,* and *Forecast.* You can subscribe to publications online or read the feature stories for free. In addition, you can conduct online searches of the archives and sources for each of these three publications.

CYFERNet (*www.cyfernet.mes.umn.edu/statis.html*) is a service with information about children, youth, and families. It covers such areas as crime and family composition, and provides a host of region-specific links.

With so many companies turning their attention to the Internet in search of new opportunities, one of the hottest topics is finding reliable statistics on who's using the Web and what works online.

Perhaps the single best site on Net demographics is **CyberAtlas** (*www.cyberatlas.com*), which summarizes all of the latest market research on the Internet, letting you grab the statistics in a flash. Want to know how many people are on the Net? CyberAtlas gives you several opinions, ranging from 5.8 million to 35 million, depending on how you define Internet user. You can delve into the detailed demographics of these users by gender and income or find out more about what cyber citizens are doing online.

Best of all, CyberAtlas provides links to many other resources including Ziff Davis's Computer Intelligence (*www.ci.zd.com*), Intelliquest (*www.intelliquest.com*), International Data Corp. (*www.idcresearch.com*), Nielsen Media Research (*www.nielsenmedia.com*), and O'Reilly & Associates (*www.ora.com*). (*PC Magazine*'s parent company, Softbank, is a shareholder in I/PRO, the owner of CyberAtlas.)

At **Multi Digital Media** (*www.mdmi.com/demo.htm*), you'll find statistics for the most commonly used online services as well as surveys and a whole series of links to other Web demographics. For a more focused look at online marketing trends, check out **ActivMedia** (*www.activmedia.com*). There you'll find overviews on Net profits, the Japanese Internet market, and Web commerce. You can read the overviews online or order complete studies.

These sites will give you an idea of the variety of research information that is available on the Web. Once you begin exploring them, you'll be amazed at how much you can learn just by pointing and clicking your mouse.

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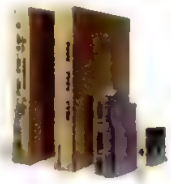

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DIGITAL PHOTOGRAPHY

Sony's Sharper Image

The Sony DSC-F1 is the new entry-level digital still camera of choice—By Daniel Grotta and Sally Wiener Grotta

There's no rule that says entry-level digital cameras have to look boxy, cheap, or weird, but most do. Then there's the $850 Sony DSC-F1, a handsome, eye-catching device about the size and shape of a cigarette pack that looks and feels like an exotic camera.

But the DSC-F1 is more than just a pretty face. Its features list reads like an extended version of the Casio QV-10's. Like the Casio digital camera, it sports a swivel lens with macro capability, a built-in color LCD viewer, and a video-out port for instantly displaying images on a TV set. The DSC-F1, however, lacks the Casio's ability to import .BMP and TIFF files for programming presentations.

But the DSC-F1 has a larger and denser 350,000 pixel CCD and an optically superior 4.8-mm (wide-angle) lens than the Casio. Those features in combination with more built-in flash memory (4MB versus 2MB) and vastly different compression algorithms, account for the DSC-F1's excellent image quality.

The DSC-F1 allows users to shoot either single frames or in continuous mode (about two frames per second). It can also record nine sequential frames (all of which can be displayed simultaneously on the LCD) within 1/30th of a second. A unique mode—called Time Machine—begins to record images into a memory buffer before, during, and after you fully depress the shutter. That way, your once-in-a-lifetime picture won't be spoiled.

The DSC-F1 also comes with a built-in flash, an interchangeable, rechargeable lithium ion battery, serial and infrared ports, and an AC adapter/ recharger. It is also the only camera in its class that offers both fully automatic and manual settings. In addition to the ability to change compression levels quickly, you can select specific shutter speeds from $^1/_{75}$ to $^1/_{1,000}$ of a second. You can't set f-stops, however.

SMALL PACKAGES: *Although only slightly larger than a cigarette pack, the Sony DSC-F1 has sophisticated features.*

We especially liked the DSC-F1's ability to transfer image data with any IrDA-equipped PC or laptop. Though the cable-connected serial interface communicates at 38 Kbps, the camera's built-in infrared port transmits each thumbnail in less than 5 seconds, as long as you put the camera no more than 2 inches from the IrDA sensor. For a limited time, Sony is bundling Puma Technology's $129 TranXit infrared adapter with the camera.

Although the DSC-F1 puts the fun back into shooting photos, the camera is weak in two areas: optics and memory. Instead of its fixed focus, fixed focal-length lens, we'd rather see an autofocus zoom lens. And while Sony incorporated SanDisk's flash film card in its DKC-ID1 midrange digital camera, the DSC-F1 curiously has no removable storage capability. That limits its capacity to 27 best-quality images.

Image quality ranged from average to excellent, depending on the subject. While the square pixels enhance sharpness and detail of rounded edges and gradients, any strong horizontal lines tend to be pixelated rather than feathered. Nevertheless, the image quality was among the best we've seen from 640-by-480 devices.

Top-notch design and manufacturing, lots of unique and useful features, and superior image quality put the Sony DSC-F1 in a class by itself among entry-level cameras.

Sony DSC-F1 Digital Still Camera. Street price: $850. Requires: 8MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later. Sony Electronics Inc., San Jose, CA; 800-326-9551, 408-432-1600; www.sony.com/image. *Circle 410 on reader service card.*

A Digital Camera for the Point-and-Shoot Crowd

While the new Sony DSC-F1 sets the standard for sophistication and versatility, the $595 Kodak DC25 strives for the simplicity of an idiot-proof, point-and-shoot camera (*www.kodak.com*). Actually, with 11 controls and 3 status lights, the DC25 is not particularly simple to use. It takes only a few minutes to learn what each button does, but it will probably take most users longer than that to become comfortable with this camera.

The DC25 is roughly 50 percent larger than the Sony DSC-F1 and twice the size of the Kodak DC20. When taking pictures with it, there are no f-stops or shutter speeds to adjust. And because the DC25's lens is fixed focus and fixed focal-length, there's nothing to do but line up the subject in the optical viewfinder. The camera's sensor automatically selects the right shutter speed—from 1/30th to 1/4000th of a second—and aperture—f4 to f11. Unlike most other entry-level digital cameras that have built-in or add-on LCD viewers, the DC25's LCD can be used to display shots only after they've been saved.

You can switch on the fly from standard to "high-quality" images—a bit of a misnomer, since the camera's top resolution is 493 by 373 pixels; standard mode is 320-by-240. Other buttons trigger the self-timer, delete the last frame, and switch among automatic flash, fill flash, and no flash.

Like the $295 Kodak DC20, the DC25 has no information panel or frame counter. A flashing light alerts you when the camera's 2MB of built-in memory is almost full. The DC25 is the first Kodak digital camera to accommodate match-book-size Picture Card flash memory cards; when you run out of memory, simply eject the current card and pop in another.

Bundled with Kai's Power GOO and PhotoEnhancer's Special Fun Edition, the DC25 is targeted at families, not business users. That's just as well, because the camera's resolution is too limited for most Web and newsletter images. But for digital cameras, it's a step toward overtaking film-based cameras in the amateur photography market.—*DG and SWG*

DIGITAL ILLUSTRATION BY MARK TYNER

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MAPPING

Dashboard GPS Tracking

With the affordable Tripmate GPS from DeLorme, you may never get lost again.—By Bruce Brown

DeLorme Mapping's Tripmate Hyperformance GPS Navigation Device bundles a 12-channel GPS reader with the firm's updated Street Atlas USA 4.0 for just $150. You get great mapping software and a nifty tool that can show you where you are, within 100 meters, at all times.

The Tripmate device weighs 12.6 ounces, and its signal yellow, weather-resistant housing measures 2 by 3 by 4.8 inches with a 6-foot cable ending with a 9-pin serial-port plug. Four AA batteries rated for about 12 hours power the Tripmate, which has no screen or on/off switch. The Tripmate uses battery power only when plugged into a PC serial port and you're using one of the two programs designed to work with it: Street Atlas USA and DeLorme's AAA Map 'n' Go 2.0.

Tripmate comes into its own on the dashboard of your car. Launch Street Atlas USA and within minutes—assuming four or more of the U.S. Department of Defense's 24-GPS satellites are in view—you'll get a reading of the exact time and your latitude, longitude, and current altitude. The GPS readings are within 100 meters horizontal and 156 meters vertical accuracy about 95 percent of the time. When used with mapping software, especially if you're traveling along highways, this level of accuracy should be more than sufficient.

Street Atlas USA has street-level maps for the entire United States, with 13 zoom levels. This new version measures distances between marked points on a map and determines the area within circles and polygons. You can also click on ZIP code boundaries and retrieve census and demographic information.

This program isn't designed for trip planning. For that, try the Editors' Choice–winning AAA Map 'n' Go (First Looks, November 5, 1996). But with the Tripmate, you can see exactly where you are on the map. You can also link to DeLorme's Web site to get updated weather, construction, and event information, either in the car with a wireless digital cellular modem or when you find a phone line.

Street Atlas USA 4.0 is also sold separately for $45 and can be used with other NEMA-standard GPS units with a PC connection. At a bargain price that more than makes up for its limited utility, the Tripmate is a terrific tool to use with DeLorme software.

TRAVEL COMPANION: *With the Tripmate running in your car, you can see your current location and speed.*

DeLorme Tripmate Hyperformance GPS Navigation Device. Street price: $150. Requires: 8MB RAM, 8MB hard disk space, Microsoft Windows 3.x, Windows 95, or Windows NT 3.51 or later. DeLorme Mapping, Freeport, ME; 800-452-5931; 207-865-1234; www.delorme.com. *Circle 406 on reader service card.*

AUDIO

Liquid Music on the Web

Offering CD-quality sound, Liquid MusicPlayer joins the battle for the Web's ears.—By Andrew Boscardin

By delivering the highest quality audio heard to date over the Internet, Liquid MusicPlayer transforms the Web into a viable medium for distributing music. Available in a beta version from Liquid Audio's Web site, Liquid Music delivers Dolby digital streaming audio to your desktop.

PC STEREO: *Liquid MusicPlayer looks like a CD player, but adds art and liner notes.*

Version 0.0.6a, which we looked at—and listened to—requires a Pentium processor for optimum performance and a 28.8-Kbps connection or faster. The interface mimics a standard CD player metaphor. In addition to the playback controls, there is a download button to save an entire file to disk and an open button that expands the interface to include more options. You can also view attached artwork, information, lyrics, and credits.

The sound quality of the examples we downloaded was clean and crisp. Occasionally audio tracks stumbled—even over our T1 line—but the player's output was the closest to CD-quality sound we've heard to date over the Net. The streaming of the files was also first rate, with only a few of the skips and pauses associated with Progressive Networks' RealAudio and Xing's StreamWorks.

At press time, Liquid Audio's site contained an impressive and eclectic selection of tunes from Sammy Hagar to Jude Swift and the Amazons. Two companies are already powering their music content with Liquid Audio: the e_mod audio room (*www.e-mod.com*) and Music Boulevard (*www.musicblvd.com*).

Though RealAudio will continue to appeal to users who desire radio-style programming, Liquid Audio is poised to become the format of choice for audiophiles and those wishing to obtain and distribute high-quality recordings over the Web.

Liquid MusicPlayer, Version 0.0.6a. List price: Free. Requires: 8MB RAM, 1.3MB hard disk space, Pentium processor, Microsoft Windows 95, Netscape Navigator or Microsoft Internet Explorer. Liquid Audio Inc., Redwood City, CA; 415-562-0880; www.liquidaudio.com. *Circle 407 on reader service card.*

PHOTOGRAPHY BY THOM O'CONNOR

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Cache External	256KB Write Back (optional)	256KB Write Back	256KB
Video Memory/Max.	1MB/2MB EDO	1MB/2MB EDO	2MB/8MB
Video Graphics	PCI Local Bus	PCI Local Bus	Matrox MGA Millennium
Diskette Drive	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB
Expansion Slots/Drive Bays	5/5 Desktop	5/5 Desktop	5/5 Minitower
Ports: Serial/Parallel	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)
Security Features	Yes	Yes	Yes
Processor Upgradable	Yes	Yes	Yes
Software Pre-installed	Windows® 95 or Windows 3.1	Windows 95 or Windows 3.1	Windows NT Workstation on CD-ROM
Limited Warranty†	3-Year	3-Year	3-Year
Price* (monitor not included)	**$1,139**	**$1,679**	**$3,419**

intel inside pentium® PROCESSOR

*All prices shown are Compaq DirectPlus prices and do not include monitors. Reseller prices may vary. Other models available, call for pricing. Call for lease prices. Leasing is provided for a term of 36 months and is subject to approved credit and certain terms and conditions. Call for details. †Deskpro is covered by a Three-Year Limited Warranty. Restrictions and exclusions apply. Some monitors and certain options are covered by a One-Year Limited Warranty. Call for details. Offer available in the U.S. only. © 1996 Compaq Computer Corporation. All rights reserved. Compaq and the Compaq Logo registered U.S. Patent and Trademark Office. Deskpro is a registered trademark and DirectPlus is a registered service mark of Compaq Computer Corporation. Products, prices and programs are subject to change without notice. The Intel Inside Logo, Pentium, and Pentium Pro are registered trademarks and the Pentium Processor Logo is a trademark of Intel Corporation. Windows is a registered trademark of Microsoft Corporation. Other products are trademarks or registered trademarks of their respective companies.

UTILITIES

Windows 95's Face-Lift

These low-cost add-ons augment Windows 95's look and feel, but they're not for everyone.—By Jeff Bertolucci

Even the most diehard Windows skeptic will agree that Windows 95's interface is a big improvement over its predecessor's. But if you want to limit other users' access to specific programs, or if you use several applications simultaneously, Windows 95 may not offer all the security controls or viewing options you require.

Two inexpensive utilities can help you customize Windows 95. Bardon Data Systems' WinU 3.0 is a $29.95 replacement interface with sophisticated security and access-control features that can help make your PC a better family member. TriPlus Technologies' WinSpace 1.0, $30, creates a virtual desktop that expands Windows 95's desktop surface beyond the physical boundaries of the monitor's screen.

Whether you want to monitor and control your child's PC time or think you deserve a wider PC window on your PC, one of these utilities is for you.

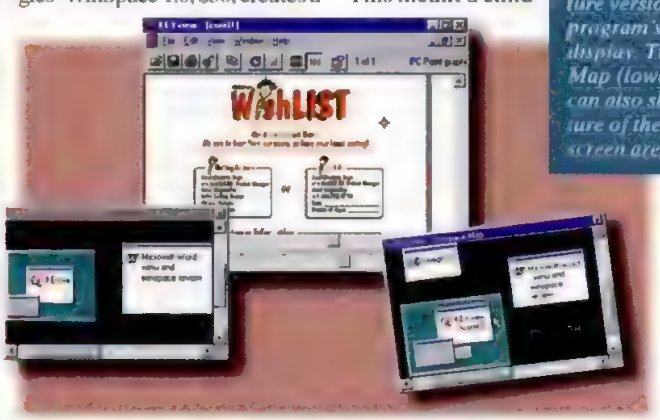
Bardon Data Systems

WinU 3.0

Designed primarily for parents who want to control which programs their kids use and the amount of time they use them, WinU 3.0 has a built-in Explorer window that lets you manage files from within WinU.

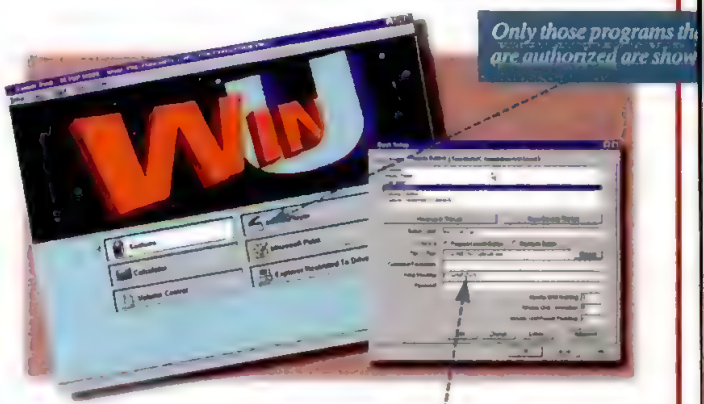
Setup is simple; the program ships on a single floppy disk and won't alter any system files other than the Windows Registry. If you're installing WinU on a single PC, you're the system administrator and must create a desk interface for each person who uses the system. Each desk is a bare-bones graphical interface, reminiscent of early DOS, that provides single-click access to applications.

For instance, we created a child's desk, with buttons for getting to Encarta, Doom, and other CD-ROM titles. This meant a child couldn't tamper with sensitive Windows system files, our Web browser, or any other off-limits areas. We also set timers that limited the amount of time Junior could spend blasting the bad guys in Doom and specified the permissible hours for PC use.



VIRTUAL DESKTOP: *The WinSpace Map (lower left) displays a miniature version of the program's unlimited display. The WinSpace Map (lower right) can also show a miniature of the actual screen area.*

During our evaluation, we found that WinU 3.0 is highly configurable, but with a sometimes baffling array of options. You can choose from among several security settings, including Convenience (no security), Casual (moderate security—and minimally annoying), and Super (industrial-strength—but intrusive). Be careful and read the manual to learn the pros and cons of each setting. In addition, there are numerous options for changing program icons, setting time limits, providing customized warning messages, applying sounds to system events, and so on.



OPEN FACE: *WinU 3.0 puts a prettier face on Windows 95 for users wanting to block access to certain programs.*

WinU 3.0 can keep PC intruders out of your system as well. Its manual explains how to prevent potential security threats like booting from a floppy disk, and it also tells how programs that run in DOS mode may defeat WinU's security features.

We wish that WinU provided more Wizard-like tutorials to guide novices through the sometimes complex setup routines, but this low-cost utility is ideal for security seekers on tight budgets.

TriPlus Technologies

WinSpace 1.0

The issue addressed by WinSpace 1.0 is entirely different: limited real estate on the Windows 95 or Windows NT 4.0 desktop. The program creates a virtual desktop of up to 4,294 to 967,295 by 4,294 to 967,295 pixels.

Power users who frequently switch between programs—a Web browser, spreadsheet, word processor, graphics program, or whatever—can place all open applications in the WinSpace desktop. They then click on the WinSpace Map, a miniature on-screen representation of the virtual desk, to jump from one piece of software to another.

Although the Windows 95 Taskbar provides a similar function, once you get beyond four or five open programs, the Taskbar becomes crowded. By comparison, WinSpace's graphical map makes it simple to see which applications are currently active and in memory. And you can still use popular Windows 95 tools.

WinSpace 1.0 isn't for everyone. But it might help you expand your monitor's horizons.

WinU 3.0. List price: $29.95. Requires: 8MB RAM, 1MB hard disk space, Microsoft Windows 95. Bardon Data Systems, Albany, CA; 800-922-2736, 510-526-8470; www.bardon.com. *Circle 401 on reader service card.*

WinSpace 1.0. Street price: $30. Requires: 8MB RAM, 1MB hard disk space, Microsoft Windows 95 or Windows NT 4.0. TriPlus Technologies; 888-874-7587 805-898-9899; www.triplus.com. *Circle 402 on reader service card.*

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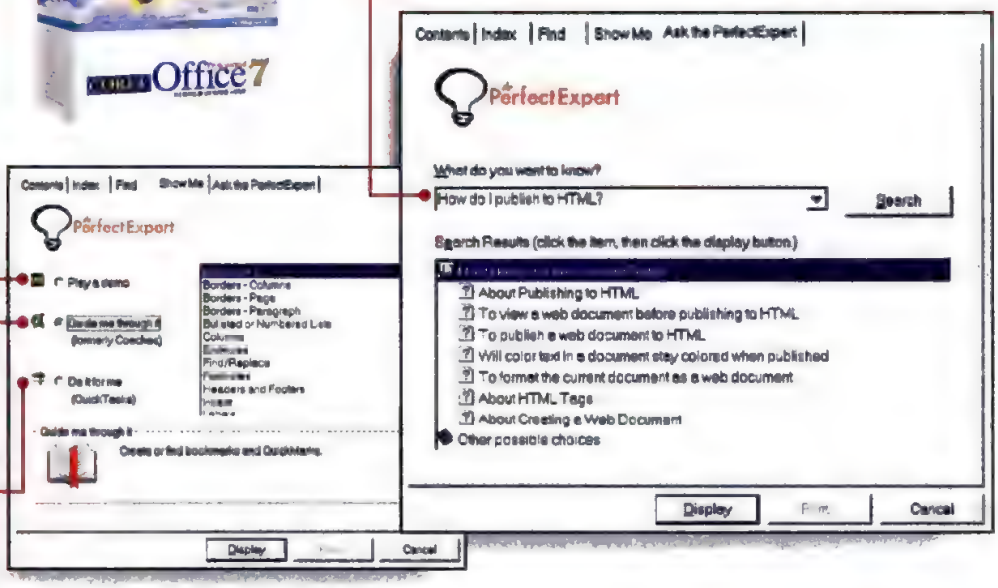

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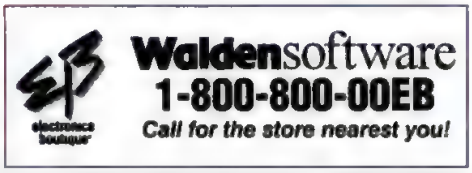

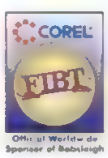

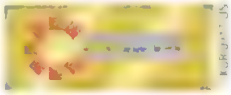

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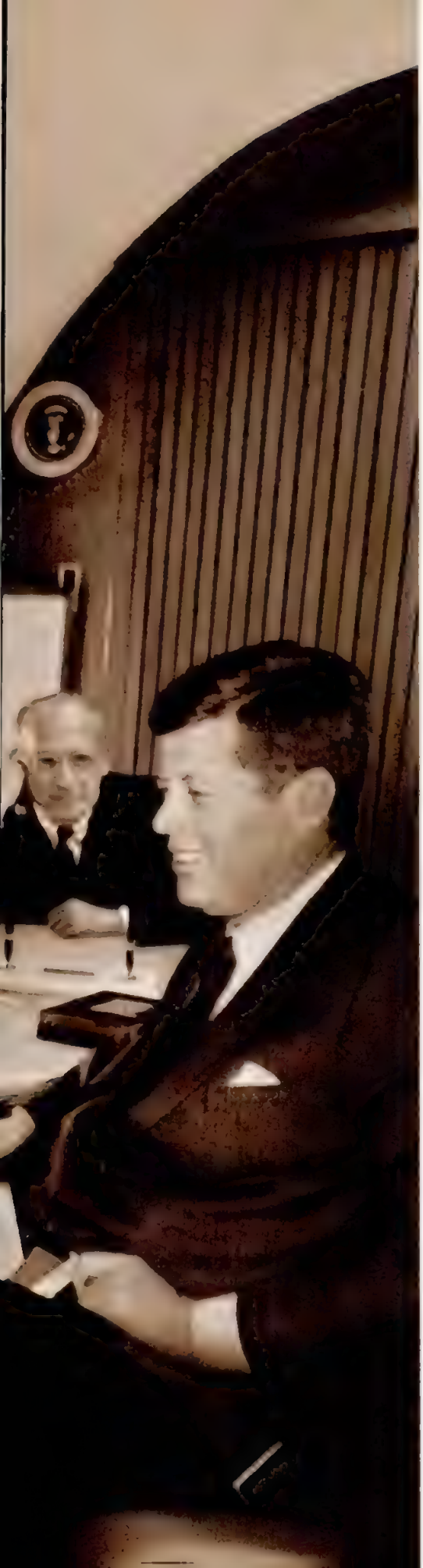

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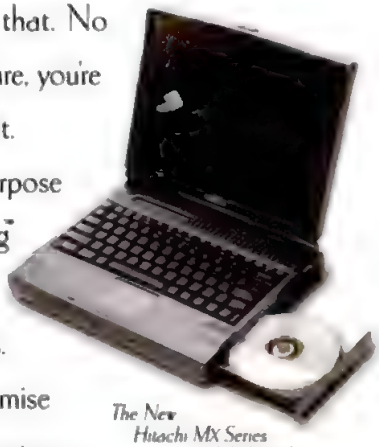

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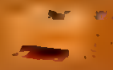
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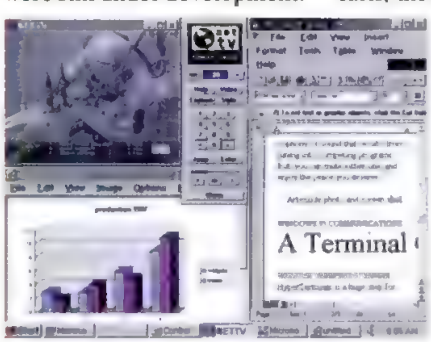
Second Looks

HOME PCs

A Couch Spud's Dream

When we reviewed the NetTV 2900 (First Looks, June 11, 1996), we were delighted with this split-personality PC that was equally at home performing traditional computing tasks and displaying television programming on its expansive 29-inch monitor. Unfortunately, at the time of our review, many of the system's components—including the PC+TV monitor—were still under development.



But in the span of six months, NetTV engineers did their homework and have produced an integrated entertainment and computing center.

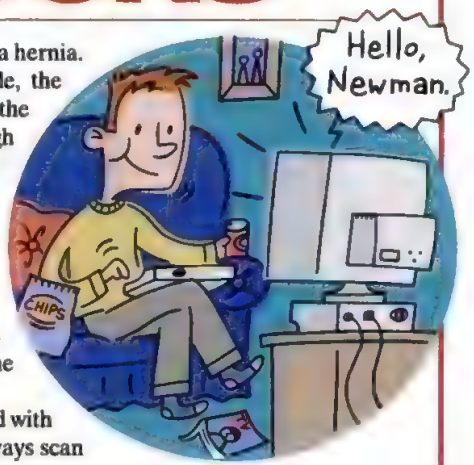
The completed PC+TV monitor yields a little over 27 inches of usable viewing space on its nearly flat glass screen. With a dot pitch of 0.75-mm, the PC+TV monitor looks great—at a distance. At prime couch-potato viewing distances of between 5 and 20 feet, you get pinpoint-sharp images, rich color, and overall impressive image quality—regardless of whether you're watching the Psychic's Friends Network, running the numbers in an Excel spreadsheet, or cruising the Web with the included 33.6-Kbps modem.

For sound, there's a pair of 7-watt speakers in the lower corners of the monitor's front panel. The sound is good, but there's no provision for adding a subwoofer. It's easy to stay in touch while reclining on the couch, thanks to the included Keytronic wireless keyboard with built-in track ball. Using it on your lap can feel awkward, though, and you're out of luck if the dog blocks the infrared signal between the PC and the keyboard.

Supporting a range of PC resolutions as well as NTSC broadcasts, the PC+TV monitor has a smaller screen than the Gateway's Destination monitor (First Looks, June 11, 1996), but it has one unmatched feature. Whereas with the Destination you have to boot up the system before relaxing in front of "Seinfeld," the NetTV can display television images independently of the computer. Just flick on the hand-held remote control.

Setting up the PC+TV was relatively easy, although labeling on the keyboard and mouse PS/2 ports would have been helpful. And it is perhaps in the nature of the beast that the backs of these devices contain mazes of cables. To use the instant-on television feature, for example, you have to attach both the monitor and the system's tuner to your cable TV or aerial connection.

This multipurpose monitor's size is a double-edged sword. The PC+TV monitor has a 29- by 22- by 19-inch footprint and weighs nearly 100 pounds. So if combining computing and TV viewing appeals to you, you might want to start working out so that you'll be able to muscle the PC+TV into your family room without getting a hernia.



On the positive side, the PC+TV's wide view of the world is large enough to work with several simultaneous windows. We were able to work on a Word document, an Excel spreadsheet, and a CD-ROM–based educational game—all while watching the evening news.

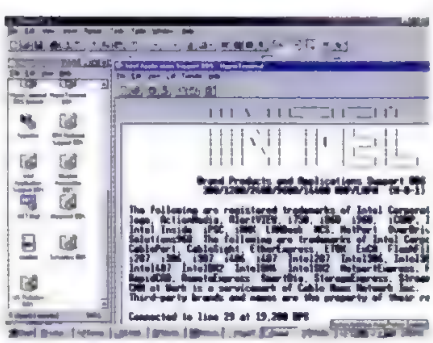
And if you get bored with the news, you can always scan thumbnails of 12 TV channels. The biggest problem with this feature is the cacophony that results from tuning into competing programs. But you can mute individual channels to focus on the most important or interesting programs.

With a superb monitor and features that make it easy to watch while you're working, the NetTV has taken us one big step closer to the convergence of computing and entertainment.

WINDOWS 95 COMMUNICATIONS

A Terminal Case

Even though the Microsoft Windows 95 freebie, HyperTerminal, is a huge step forward compared with the anemic Windows Terminal from Windows 3.*x*, it is far from an industrial-strength communications program.



Hilgraeve's HyperTerminal Private Edition, Version 2.0 (HTPE 2) sets a new standard for what to expect from free software.

HTPE 2 is worth the time it takes to download the 658K compressed file from *www.hilgraeve.com*. The program fixes a bug in the original release of HyperTerminal that prevented the display of some foreign character sets, and it adds support for TCP/IP telnet sessions.

New features of the 32-bit HTPE 2 are its automatic redialing of busy numbers and its graceful recovery from interrupted file transfers. And for BBS jockeys, HTPE 2 provides an assortment of shortcuts. The program also provides similar connections for AT&T Mail, CompuServe, and MCI Mail.

Hilgraeve's HyperTerminal Private Edition is one of the Internet's best giveaways.

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Horizontal Frequency	30-115 KHz	30-107 KHz	30-95 KHz	30-95 KHz	30-86 KHz
Video Input Bandwidth	250 MHz	230 MHz	200 MHz	200 MHz	135 MHz
Maximum Resolution	1800 x 1440	1600 x 1280	1600 x 1280	1600 x 1280	1600 x 1280
Optimal Resolution	1800 x 1440 @ 76Hz	1600 x 1200 @ 85Hz	1600 x 1200 @ 76Hz	1600 x 1200 @ 77Hz	1280 x 1024 @ 80Hz
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Needed: Client/Server Telephony

The public switched-telephone network is the world's biggest host computer. Yes, it's distributed in that each central-office switch (actually a computer) is a peer to every other central-office switch, with some machines that manage the network and handle long-distance calls and handoffs to other telephone companies thrown into the mix. The architecture reflects that of the mainframe, where all the intelligence is in the glass house, and the user's instrument is dumb.

Today's telephone instruments and accessories have a limited amount of intelligence. They can store and redial numbers. They can provide multiple voice mail boxes, and they do a couple of other tricks. But mostly, they're dependent on the host to get the job done.

Every one of those millions of tendrils that make their way out of the central office and to your home or small business is a telephone number. Each time you add a modem, a fax machine, or a cellular phone, another number is gobbled up. Got a teenager or two in the house? There's another couple of numbers gone. As a result, telephone companies keep running out of phone numbers.

But the problem is deeper than that. The old host-centric model just doesn't match the way we use the telephone system any more, despite the best efforts of the telcos. For instance, I've gotten a number of calls in which people have said, "Oh, Bill! I didn't really want to bother you; I just wanted to leave a message on your voice mail." So why isn't there a set of Touch-tone codes to do exactly that?

Think of the residence as a business. Businesses are served by private branch exchanges or switchboards. The first reserves a block of numbers within a master number, and you can direct-dial any employee with a seven-digit number, plus the area code. In the second method, either a human or a machine answers the phone, and you give a name or an extension number in order to reach your party. In both cases, the company actually has significantly fewer phone lines assigned to it than it has extensions. The PBX connects the incoming phone line with the right desk and automatically kicks over to voice mail if your party isn't there. With the switchboard, the local intelligence is embodied in the receptionist/operator (although I once had one who told a caller, "Mr. Machrone is out to lunch. Would you like to hold?").

PERSONAL PBX

Computers are small and cheap enough for my end of the phone wire to get far more intelligent.

As nice as it is to talk to a human being sometimes, it's more efficient to steer your message where you want it to go. I for one don't want a separate number for every telephone-enabled device in my home office, plus ones for my cellular phone or pager or both. Computers are small enough and inexpensive enough for my end of the phone wire to get far more intelligent. All we really need is a set of protocols that let the calling instrument (be it phone, fax machine, or modem) and the receiving side know that this is a machine-to-machine conversation, or that a machine is mediating for a human.

Thus, I can initiate a call with a button or code that means "go straight to voice mail." Or if you need to reach me urgently, you could initiate a call with a "try all alternative devices (pager, cell phone) before voice mail" code. On the receiving end, I would have my pager and cellular numbers programmed into my smart phone/PBX. In addition, I could decide when I don't want to be bothered (but could also give override codes to friends).

We've evolved far enough in voice recognition that virtually any caller could say the name of one of the four residents in my household and be connected to him or her. Or by adding the phrase "voice mail," a caller could route a message to a message box. Think how much better this would be than the dreary "Press one for Bill, two for Sharon . . ." litany. I'd want my ideal home or small-business PBX to work both ways—ultimate convenience for people and ultimate efficiency for machines.

With the coming of high-bandwidth digital connections and a sensible client/server architecture, we wouldn't really need all those extra numbers and area codes. One number per household would suffice, and the protocols I'm suggesting would request and negotiate a piece of bandwidth suitable to the task at hand. You would never get a busy signal, just a change in the balance. So even if you're using your phone for streaming video from the Internet when I call, my call gets answered. Your video bandwidth is reduced by 40K or 50K, and the voice call goes through. Sounds like progress. □

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The Decline of Desktop Computing

There is no denying it. Java has become the rallying point for a large-scale, anti-Microsoft, anti-Intel movement to take the personal out of personal computing. Secretly, Microsoft must surely be freaked. What's really going on is the reemergence of a natural schism between desktop personal computing and enterprise/corporate computing. Large businesses are looking for a way back to the mainframe model, because the networked PC is simply too expensive and too much of a hassle. True, the installation of PCs is relatively inexpensive, but maintenance and upgrade costs have turned out to be budget-busters.

Just take a look at what's happened with operating systems alone. Over the past ten years, Microsoft has released Windows 1.0, Windows 2.0, Windows 386, Windows 3.0, Windows 3.1, Windows 3.11, Windows for Workgroups, Windows NT, Windows NT 3.5, Windows NT 4.0, and Windows 95, not to mention all the non-Windows flavors—including a slew of DOS versions and a version of OS/2. This is a lot of stuff to absorb. And let's not even discuss all the iterations of Microsoft Word, each one coming with new file structures.

On top of all this, we can't ignore the never-ending processor upgrades from Intel. Every few years, the company introduces a totally new processor to be followed by an endless parade of clock-speed upgrades. Now we have MMX to deal with. So along comes thin-client computing, which incorporates an old idea that appeals to the big companies: a single point for upgrades. It's at this juncture that Java has cropped up as a platform for network computers.

RABBIT, RUN
Corporate America wants off this PC treadmill and is willing to try anything.

Individual users may be willing to spend money on annual upgrades. But corporations simply can't afford to support, maintain, and continually upgrade legions of desktop PCs. Corporate users often bootleg the software and introduce viruses to the network. Those users demand the latest and greatest machines, as well as good laptops, and ask for constant upgrades. Or they complain bitterly. It's just not cost-effective or beneficial. In fact, it's a mess. There is absolutely no stability here. Corporate America wants off this treadmill and is willing to try anything.

Microsoft is aware of these problems and along with Intel is promoting a concept called "cost of ownership." The idea is that Plug and Play technology—along with new, easier-to-use programs—will save companies money. Of course, everyone will have to upgrade again to get these advantages. In my opinion, the cost-of-ownership concept has actually damaged the Wintel juggernaut by forcing the companies and their customers to acknowledge this problem. The issue was always simmering under the surface, but now it's come to a boil. Corporate America is waking up and saying, "Gee, we weren't just imagining this problem. It's real!"

To make matters worse for Microsoft, the company's nutty commitment to all things Web-related and to the browser model will do nothing but hasten the trend toward thin-client computing. By giving away browsers and pushing people toward the Net, Microsoft is in effect pushing people toward a generic interface that can run on any platform and is perfect for thin-client computing. Thus, a thin-client system running off, say, an AS-400 server using Unix and intranet tools with a GUI browser might look and feel like Windows, but close examination would reveal no Microsoft anything running on the system.

The potential for a mass movement away from the Wintel rat race is why we keep hearing outrageous predictions for intranet-related revenues. But is it possible that Java-mania is just part of a larger phenomenon—the return to thin-client computing in corporate settings—that is long overdue? One telling sign is that IBM is now right in the thick of it, trying to get back to the centralized world in which the company made its fortunes. Big Blue says it's putting more development money into Java than Sun is. IBM wants to get back into a business where there are real margins and true profits: centralized computing.

There is no question in my mind that the short-lived merger of personal desktop computing (what we used to call *microcomputing*) with corporate information systems is about to end. What will emerge from the ashes will be two distinct tracks of computer development: thin clients at work and personal computers at home. In some ways, we'll be back where we started in the 1970s—only the machines will be a lot faster.

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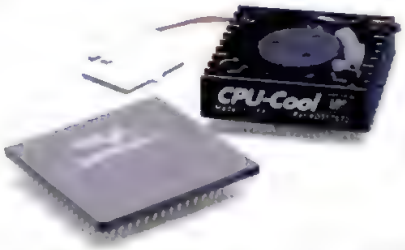

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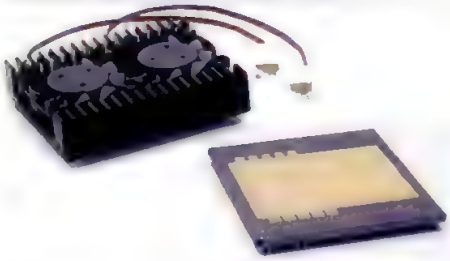

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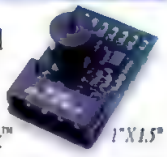

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Inside Track

Fall Comdex last November revealed **new trends** and new dimensions in the PC industry. It also revealed new trends and new dimensions in the city of Las Vegas itself. The **ramifications** of the latter are unknown.

The town, which I thought was already **overbuilt** three or four years ago when the MGM Grand opened, is continuing to grow to excess. Old-timers are quite concerned. At least a dozen projects are underway, each one enormous. **The most amazing** (so far) is New York New York, a huge hotel complex located across the Strip from MGM. To see this **incredible and somewhat perverse** hotel as well as other Comdex 1996 pictures, go to my Web page, at *www.pcmag.com*.

In terms of Internet products, it was the same stuff, different year, and the interest of the show-goers was noticeably down. The buzz is over, and the boring consolidation phase has begun.

The famous Sands hotel is about to be flattened to make room for the world's largest hotel, which will have **6,000 rooms.** Currently, the MGM Grand holds the record, with 5,005. The Sands is owned by the former owner of Comdex, Shelly Adelson; apparently he's decided to put his profits to use. The hotel is modeled after a city (Venice, gondolas and all), in much the same way New York New York and another, just-announced hotel (this one complete with an **Eiffel Tower)** are.

This town is due for a crash. Whatever the case, Comdex won't be responsible. This trade show packs the place with 200,000 show-goers, and that's conservative.

Comdex had three themes: the network computer, the Internet, and display technology. NCs were being touted by everyone, and a strident debate has begun regarding their place in the world. All the weekly trade magazines had editorials predicting the success or the failure of NCs. But it's still too early to tell for sure.

In terms of Internet products, it was the same stuff, different year, and the actual interest of the show-goers was noticeably down. "Didn't we see this same stuff last year?" The buzz is over, and the **boring consolidation phase has begun**.

Display technology centered around the **large plasma panels** that every Japanese company was showing. The panels were all **big and cool-looking** but very pricey. At $10,000 a pop for 40-inch plasma displays, you know few are going to be sold. In conversations with a flat-panel display analyst for a large brokerage firm, I was briefed on the possible **drawbacks of the technology:** (1) By nature, the technology is good for large displays only and can't scale down. So it won't hurt LCD sales. (2) It's expensive. (3) It's a power hog. And while looking at a Panasonic device, I noticed another potential problem: When the device is given a fast-motion feed, the image exhibits excessive posterization. **It was annoying once you started to focus on this anomaly.** Still, I can imagine that a giant, Jumbotron-like plasma display will eventually be hanging in Times Square.

I spent most of my time looking at one-off technologies and ideas that got little attention. **I was quite impressed with the new Newton MessagePad 2000.** It's about 1.5 pounds and now has two PCMCIA slots. Four AA batteries will power the unit for about three to six weeks. A microphone is built-in, and you can actually annotate a recording on the fly. The annotations can be linked to exact points in the recording so that the notes and the sound match up. The MessagePad has a bigger screen than the previous unit and is about ten times as powerful. The key to this thing is the StrongARM SA-110 chip, from Digital Equipment Corp. The one used in the MessagePad runs at 160 MHz and chews up only one-quarter watt of juice (and this from the same people who bring you the **watt-guzzling** Alpha chip). The actual MIPS this chip delivers is problematic, since **the engineers at Digital seem to have lost their calculators.** Here, take the following quote from the press release and do the math: "*The StrongARM SA-110 chip chosen for the Newton platform operates at 160 MHz...dissipating less than one-quarter watt of power.... In the Apple MessagePad 2000, the StrongARM microprocessor delivers an unprecedented 925 MIPS/Watt.... StrongARM speed options [range] from 115 MIPS at 110 MHz to 270 MIPS at 233 MHz.*" Makes no sense, but it's obviously no slouch of a chip.

Genuinely Interesting Hardware/Software Dept.: If there was an overlooked product at the show, it was only because the company was **buried in the corner** of the Sands Convention Center. The Tripmate GPS (Global Positioning System) receiver, from DeLorme Mapping, caught everyone by surprise. This product comes with Street Atlas USA 4.0, a complete map of the U.S., **interfaced with a GPS receiver** that can be hooked to a laptop through the serial port. The whole bundle costs $149. This is nothing less than a **stupendous price** since it's hard to get a used GPS receiver for $149. DeLorme is located in Freeport, Maine; details of the Tripmate can be found at *www.streetatlasusa.com*.

I ran into another vendor, Chicago Map Corp., that was just about to roll out a similar system for $350. The difference is that this product's GPS device has an LCD readout, so it can be used as a standalone device. I don't know about you, but when flying across the country, sometimes I look out the window and see some unusual sight. It would be cool to boot up a laptop and open the GPS system and see exactly what it is you were flying over. Unfortunately, you can't, because these inexpensive GPS receivers are programmed to quit at 99 miles per hour to prevent pilots from using them. □

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JIM SEYMOUR

How to Think About NCs

The avalanche of publicity about network computers, or NCs, has reached a peak, I hope, over the past couple of months. IBM, Sun, and other box builders have been rolling out—or at least previewing—their new "office information appliances." Corel began showing previews of its NC-focused, Java-only WordPerfect Office suite. The "Damn Microsoft" claque in the second balcony, led by Larry Ellison at Oracle, yelled "Hooray!" at every announcement.

Meanwhile, Microsoft and Intel surprised many with their own announcement of an NC-like hardware standard. But unlike other NCs, which will run on Java derivatives and thus make the operating system both platform-agnostic and nearly irrelevant, the "Wintel NC" (to coin a phrase) will run . . . Windows derivatives. Surprise, surprise.

Outside the business, pundits and publications have been weighing in with their considered (or at least considerable) opinions on how that bad ol' symbol of wanton waste and techno-excess, the PC, will soon be buried under a wave of tiny, cheap machines with blissfully limited functionality. No more will once-productive but now bone-idle employees waste time making PowerPoint presentations: Sun chairman Scott McNealy, one of the biggest NC cheerleaders, says the best overhead presentations are made by hand with a plastic sheet and felt-tip pen, in 5 minutes or less. (I'm not kidding. He really said that.)

There's been a lot of Newspeak uttered, too, on behalf of NCs. The most egregious example is Sun's advertising slogan for its new JavaStation: "What FREEDOM Looks Like!" NCs aren't about freedom at all, friends, but about control, and about reasserting the control that IS once held over its terminal-using "customers." *Forbes* magazine, which I otherwise admire greatly, capped the NC-over-PC hype in November with a cover story on the importance of "right-sizing your PCs." Which meant, *Forbes* decided, dumping them.

This myth that we were once strong, proud, industrious, hardworking folks who didn't waste time on silly PC games but have lately fallen victim to the allure of such things as italic type and cutesy clip art is an insulting one. But it is becoming pervasive, even though the idea that the very depth and richness of the tools offered by today's PCs and PC software keep us from real work, distract us, and turn us into time-wasters is largely nonsense. To assert that we'd all be a lot better off with vastly more limited tools—and believe me, NCs are *much* more limited devices—is to suggest that we possess neither judgment nor a sense of responsibility, that we'd really rather be down at the video arcade.

A TIME, A PLACE

It took me a while to recognize the merits of some of the arguments made in favor of NCs.

But there is another side to the pro-NC argument. It posits that the costs of choosing, purchasing, installing software on, and delivering PCs to workers' desks—plus the continuing costs of supporting the anarchic computing environment that results—are huge, out of control, and unnecessary. And just between us, there is some truth to that.

Indeed, NCs are in many ways appealing, appropriate, and even cool. I see many uses for them in business, and I'm convinced they're going to be a big success in some roles.

If you're still reading, take a deep breath. I know, putting up with the guff about NCs makes recognizing their real value difficult. I've spent almost 20 years walking the hallways and pounding the conference tables of Corporate America, arguing for the proliferation of PCs, for the one-person/one-CPU principle, for empowering workers by giving them access to tools that will genuinely help them do their jobs better. So I sucked air for a while, too, on NCs. It took me a while to recognize their worth and the merits of some of the arguments made in their favor.

The fact is, though you and I and many of the people with whom we work certainly need the power and flexibility of PCs, a lot of our coworkers don't. People who boot up 15MB word processors to write 15-word e-mails are not making rational use of a $3,500 computer.

To give the devil his due, when Scott McNealy says that to write all he needs is to backspace, delete, cut-and-paste, and print, he's about right: No one would accuse Scott of being much of a writer, nor for that matter a preparer of budgets, proposals, business plans, contracts, presentations, or any of the other work you rely on your PC to help produce. Scott's role at the top of Sun is to bang out short, pithy e-mails

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JIM SEYMOUR

in response to work of the sort done and submitted to him for approval by other people—people who you may be sure don't use NCs or NC-like devices, but rather Sun workstations powerful enough to launch missiles. In a phrase I once thought headed for oblivion, *he has people to do that for him.*

In many companies I work with, half or fewer of the workers really need the power and flexibility of a true PC: They'd be well-served by an NC. They read and respond to e-mail messages, writing their own brief messages and replies live, in real time. They use the company's intranet to look up phone numbers, or check on HR benefits rules, or maybe file expense accounts. Nothing they do with that box on their desk demands a PC. So let's give them NCs.

Whatever you may think of the idea of NCs, I think it's clear that we're moving away from the homogeneous PCs-only desktop-computing environment and toward a much more heterogeneous computing environment. The wide adoption of notebook PCs was an early harbinger of that change, but we didn't understand that. So when the idea of the NC came along—a simple, basic, cheap device well-suited to many office workers' computing needs—we also failed to recognize the contributions it can make.

The world of NCs is good for you and me, as long as the IS managers in your company (and mine) don't go too far, taking away one of our costly-to-support PCs and replacing it with an NC. Again: You have to make that call on an employee-by-employee basis, not blanket it over a broad classes of workers. The world of NCs is good for IS people, too, for they will be able to restore some semblance of control and balance to their user communities.

The NC isn't good news for traditional PC hardware makers, which find little joy in the prospect of selling a $700 to $1,000 machine instead of a $2,500 to $3,500 box. It also isn't good news for software publishers, for in the new world of NCs, the list of applets in wide use is going to be a lot shorter than today's lists of PC productivity apps.

Resist the temptation to condemn reflexively both NCs and those who praise them. Sure, the loudest voices may have their own less-than-honorable agendas, but that doesn't mean the technology is fatally flawed. We won't succeed in integrating NCs into business or delivering that *truly* right-size chunk of computing power to each worker's desk by blindly condemning new ideas and products. □

Bye-Bye, Pentium?

Pentium Classic CPUs don't make sense any more. The microprocessor you really want to power your next PC will be either the Pentium Pro or the new Pentium with MMX. Between them, these two choices offer such intriguing price/performance benefits, it's hard to see why you'd stick with a plain old Pentium.

That was one of the themes of fall Comdex, the annual pre-Thanksgiving trade show that draws 200,000 people to Las Vegas. Here's my take on the show.

Pentium gets squeezed out. Two months before the expected early January unveiling of MMX, many were convinced that there would be a shortage of MMX-enabled Pentium microprocessors. Systems based on Pentium processors with MMX technology—Intel's multimedia extensions—will be priced about the same as Pentium Classic systems. We've heard vendors predict that the price difference will range from zero to $200. But at even $250 more, you're buying a cheap insurance policy against future obsolescence, or "investment protection." Two or three years from now, some applications, such as image-editing software, videoconferencing, and games, might even require MMX extensions just to run.

MMX-PECTATIONS

50-percent gains on some applications seem possible. At that point, you'll want to think MMX.

A larger internal cache makes an MMX system perform almost as fast as the next-faster straight Pentium processor—meaning a 166-MHz MMX would give a 200-MHz Pentium a run for its money on any application. On applications tuned for MMX (but that still work on all CPUs), the boost could be more significant. Our tests with an early MMX prototype showed gains of no more than 20 percent, but we think 50-percent gains on some applications might be possible. And it could be more. At that point, as a buyer, you'll want to think MMX if you're in the market for a Pentium-level PC. Meanwhile, with RAM so cheap, business buyers will want to give even more thought to 64MB Pentium Pro systems running Microsoft Windows NT. Yes, 64MB of RAM—memory is that cheap.

Personal color printing gets a lot better. When I moved to the New York area 11 years ago to join *PC Magazine,* I boxed up my darkroom, convinced digital photography was just around the corner. We're just about at the corner now. You'll see $500-and-under printers due within the next 12 months that are getting *very* close to being able to make you think an ink jet print is a photographic print. (Cost is still going to be an issue, however. You won't save much, if anything, over having the photos enlarged commercially.) And, of course, all this technology benefits the color quality of ink jet printing in general.

Digital cameras get a bit better. If you want the best front end for your digital darkroom, it's still going to be a traditional camera and scanning for a couple of years yet. Digital camera prices are coming down and CCD sensors (the electronic equivalent of the film) are going up in resolution. But color correction remains problematic, and you can only take a dozen or two photos before the camera fills up, which is a big problem unless you're planning to take your laptop on vacation so you can off-load images. But as a medium for capturing images for use in company newsletters and on Web sites, the technology has arrived.

DVD is coming. Son of CD-ROM, these 4.7GB (initially) drives should finally be available come spring, both in versions for PC users and for home-theater use. Virtually every vendor that now makes CD-ROM drives or VCRs was showing DVD drives at Comdex. Video quality will be sensational provided you get properly mastered source material, and the data capacity is just what we need. There will be a chicken-or-the-egg dilemma for a year or two: Until there's more material on DVD, users won't buy the drives, and until there are more drives, more material won't be shifted over from traditional CDs and videotapes. Price: $500 to $1,000.

Wait—there's more. I heard lots of talk about the PC versus the network computer at Comdex, but this was really a PC-centric show, where more people believe that the answer is not to switch platforms but to drive down the complexity and cost of ownership of a PC. . . . The Internet-server-in-a-box is catching on. Server vendors now offer simple solutions that let small businesses set up an Internet server in a couple hours. . . . Some programs out there help you deal with all the information on the Internet by letting you download pages from Web sites so you can print and read them at your leisure. And here we thought the Internet and big-screen monitors meant the death of paper. *Plus ça change.* □

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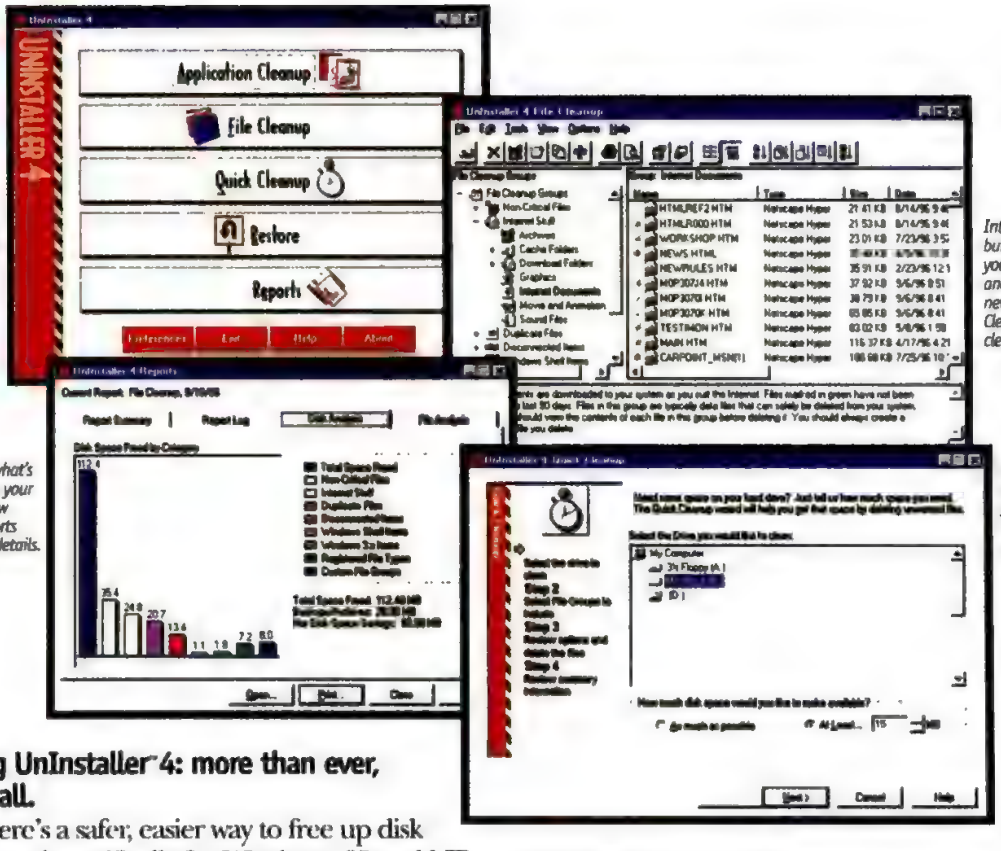

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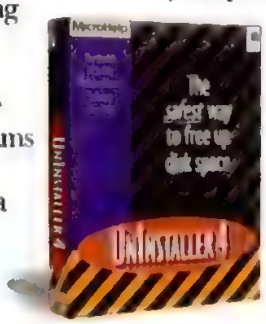

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NETWORK EDITION

DIRECTORY SERVICES

From NOS to Net

Directory services face new challenges as networks grow, diversify, and connect to the Internet.

By Robert Norton and Tony Pompili

Growing companies have seen their networks expand from workgroups based on a single server, to departments based on several servers, to hundreds of servers worldwide. Not only have networks been getting larger, many are running multiple network operating systems and providing users with access to the Internet and corporate intranets. As the complexity of networks has grown, network administrators have found it more and more of a challenge to manage network users and resources. Directory services, the repositories of network user and resource information, have had to grow and change to meet this challenge.

ILLUSTRATION BY ANDREW FAULKNER

INSIDE

PC MAGAZINE

It seems like just yesterday that Novell's NDS (NetWare Directory Services) represented a breakthrough in directory technology that would greatly simplify life for millions of corporate NetWare users. Single-server log-ons were a thing of the past; you could look at your NetWare network as a whole.

BUT LIKE EVERYTHING ELSE in the world of computers, that just wasn't good enough. Today's networks are a jumble of separate NOS and application directories, each of which has to be updated individually. On top of that, now there's the worldwide network of the Internet to deal with, and nobody speaks the same directory language. Suddenly you're hearing all kinds of new directory jargon—*LDAP* and *metadirectory*, for example.

THE WORLD OF DIRECTORY services is demystified in this Network Edition cover story. Project leader Robert Norton and contributing editor Tony Pompili examine the directory technologies that exist today—including IBM's Directory and Security Server, NDS, and Banyan's StreetTalk for Windows NT—and discuss past and future trends affecting this all-important area of network computing. They even look at new directory services based on LDAP and an example of a metadirectory from Zoomit. Whose will become the one single global directory? As usual, no one's. But some are sure to become more generally accepted as standards than others.

PERFORMING BACKUP OVER the Internet is the topic of Multiple Access. West Coast PC Labs director Steve Buehler tells you how to enable your network users to do their own.

—Leon Erlanger

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For this feature, we examined existing and emerging NOS directory service products to see what vendors are doing to help administrators meet the challenges of today's and tomorrow's networks. We looked at a range of products, from one-NOS directories, such as NetWare Directory Services (NDS), to Zoomit Corp.'s Zoomit VIA, a new metadirectory product that attempts to manage multiple NOS and application directories from a single application. We also looked at IBM's Directory and Security Server, Banyan Systems' StreetTalk for Windows NT, Netscape Directory Server, and Microsoft's plans for Windows NT Version 5.0's Active Directory.

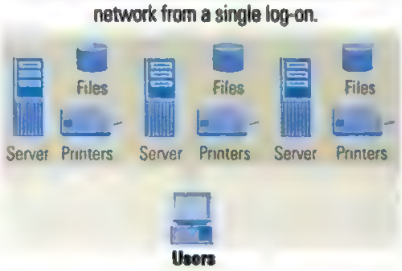
All of the directory services we looked at for this feature have hierarchical architectures. This means they represent network information in treelike structures that can mirror the structure of an organization, with limbs representing divisions and departments, and leaves representing network objects such as users, servers, and printers. Each limb can be assigned its own rights which apply down the limb, and all limbs can be administered from the tree's main trunk.

We didn't examine the existing domain-based directories of Microsoft NT Server and IBM's OS/2 Warp Server. Domain-based directories have a flat architecture in which each domain represents a logical grouping of servers. Administrators can provide users with access to resources across the enterprise by creating so-called trust relationships between each set of two domains. For large organizations, domain-based directory architectures are inherently more difficult to manage than hierarchical directories.

Directory Service Evolution

Single Server, Single NOS
Early NOSs such as NetWare 2.x and 3.x required users to log on to individual servers to gain access to files and resources.

Multiple Servers, Single NOS
As networks grew, NOS directory services provided users access to files and resources across the network from a single log-on.



Multiple Servers, Multiple NOSs, Multiple Applications, the Internet
Today, network directory vendors are faced with the challenge of multiple NOSs, e-mail, and the Internet. LDAP will let different directory services exchange information. Metadirectories will provide a single source for managing a variety of directory services.

THE HISTORY OF DIRECTORIES

To gain perspective on the trends affecting directory services today, it helps to examine their history. In the beginning, there was the network operating system (NOS). NOS directory services such as Novell's bindery quickly became essential vehicles for defining user and resource access to a file server and to the printers, modems, and other resources attached to that server. One of the most basic directory tools, the log-on process, became essential for managing access to resources. Also called authentication, the log-on process lets the server verify users by requesting passwords and user names. Running on the client and server, the log-on process encrypts this information over the network for security purposes.

The server-based structure of the NetWare bindery meant that administrators had to log onto each individual server to assign rights to that server's resources. Conversely, in order to access a network resource, users had to know which server it was attached to and how to log onto that individual server.

As networks grew, single-server log-ons became cumbersome for both users and administrators. To provide a more network-oriented approach to managing resources, directory services evolved in two directions: Novell's NDS and Banyan's StreetTalk provided hierarchical directory services, while Microsoft Windows NT Server and IBM's OS/2 Warp Server provided domain-based services. Both methods were a considerable improvement over server-based directories, since they let administrators give users access to resources across several servers from a single log-on. The hierarchical model proved to be more flexible than domains, however. Microsoft admits to the deficiencies of its current NT directory services and has announced plans to move to a hierarchical model in Windows NT 5.0 (see "Directory Services Tomorrow," later in this story). IBM has already released its DSS to provide a hierarchical directory to OS/2 Warp Server and other IBM NOSs.

For organizations that run on a single NOS, today's hierarchical directory services provide excellent management capabilities. Of course, few companies run their networks on a single NOS, and each NOS's directory services must be administered with its own set of tools. To make matters worse, multiple directories frequently have a great deal of redundant data. For example, Jane Doe is probably not just a NetWare user but also a Windows NT user, and maybe even a VINES user. Unfortunately, the administrator has to create three different sets of access rights for Jane in three separate systems, using three separate sets of tools. And each set of rights has to be updated each time Jane moves to a new department, changes her phone number, or leaves the company.

DON'T FORGET APPLICATIONS

As if managing NOS-based directory services was not complicated enough, a network administrator must also keep track of application-based directory services. These usually come with messaging products such as Lotus cc:Mail, Microsoft Exchange Server, and Lotus Notes. Where NOS-based services keep track of OS user rights, application directory services manage application- and user-specific in-

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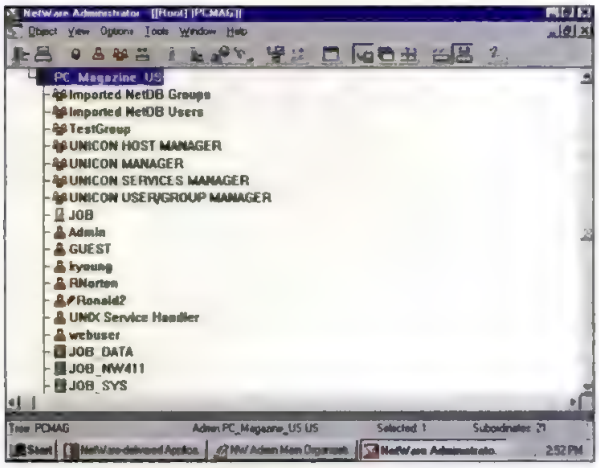

A classic hierarchical directory service, *NetWare 4.x's NDS presents the network in a tree structure that can mirror the structure of the organization.*

formation. For example, a messaging product will store user information such as name, telephone number, and E-mail address, as well as the location of that user's post office. Sometimes called the white pages, application directory services work like standard databases to provide lookup services about people and resources.

Unfortunately, as with NOS directory services, each application's directory service comes with its own tools for creating users and groups and assigning rights and permissions. Also like NOS services, application directory services have limited interoperability with other application or NOS directory services.

BRINGING IT ALL TOGETHER

Typically, the solution for managing an entire directory service structure (including multiple servers, NOSs, and applications) has been to train one or more administrators to manage each environment at the local or enterprise level. New employees are entered into each system individually.

One way to keep your NOS directories in sync is to turn to a NOS integration product. Although it was still in beta at the time of our review, NetVision's Synchronicity for NT ($995 list and up; NetVision, 801-785-5190; *www.netvisn.com*) seems to be a product with potential. Synchronicity should allow you to keep Windows NT and Novell directories up to date easily because changes to one directory service will be automatically reflected in all other directories. Synchronicity runs on Windows NT and should be available by the time you read this.

Other approaches to solving the directory mess are discussed in upcoming sections. On the NOS side, Novell plans to port NDS to other NOSs including several Unix flavors and Microsoft Windows NT Server. Metadirectories, such as Zoomit's VIA will attempt to let administrators manage a number of NOS and application directories from a single application.

In addition to avoiding the duplication of user data, consolidation and standardization of directory services greatly simplifies such third-party cross-platform network management applications as Symantec's Norton Enterprise Backup. Today these applications have a separate interface for each directory. Many existing directory vendors provide APIs to enable applications to access their directory information. These include Microsoft's ODSI, Lotus Notes APIs, and NDS APIs. The drawback is that application vendors must write code for each API in order to integrate with that vendor's services. For a long time, the X.500 standard (see the sidebar "LDAP: The Key to the Global Directory?") has held promise as a way to provide a single global directory standard that NOS and applications could address. Unfortunately, X.500 is based on Open Systems Interconnection (OSI) codes, whose large size create significant overhead if vendors wish to include X.500 hooks in applications.

Luckily, a streamlined version of X.500 is on the verge of becoming a viable, standards-based alternative for directory services. It's called the Lightweight Directory Access Protocol, or LDAP, and it promises to ease integration of various NOS and application directory services. In the future, writing an application to comply with the LDAP protocol will ensure directory integration with a variety of other NOSs and applications.

If the time and expense of maintaining several directories is getting out of hand, it's time to reconsider your directory service strategy. The following pages offer some ideas for doing so.

DIRECTORY SERVICES TODAY

While they are no longer server-specific, today's directory services remain mostly NOS- or application-specific. There is some movement toward multi-NOS coverage and NOS application integration: Several NOS vendors, including IBM, Novell, and Banyan have either moved their directory services to new platforms or announced plans to do so within the next six months. A few applications share names and security with NOS directories, notably Microsoft Exchange with Windows NT Server and Novell Groupwise with NetWare. And Novell, Microsoft, and several application vendors have announced plans to support LDAP (see the sidebar "LDAP: The Key to the Global Directory?").

Today, however, with each installation of a new NOS or secured application, the network administrator is essentially faced with another directory that has to be updated manually every time there is an addition, move, or change.

In this section, we examine three NOS-specific hierarchical directory services—Novell's NDS, a component of NetWare 4.11; IBM's Directory and Security Server (DSS), an add-on to several IBM NOSs, including OS/2 Warp Server; and Banyan's StreetTalk for Windows NT.

NETWARE 4.1 AND NDS

Before NetWare 4.0, the administrator had to manage his NetWare network as a group of unrelated servers—each with its own separate list of users, passwords, and file-system rights. With the release of NetWare 4.0, and through the present NetWare 4.11 ($1,095 and up; Novell, 800-453-1267; *www.novell.com*), the administrator now can use NetWare Directory Services (NDS) to administer the network as a single entity, with an underlying infrastructure based on either organizational structure or geographical layout. Now users can access files and resources anywhere on the NetWare network with a single log-on.

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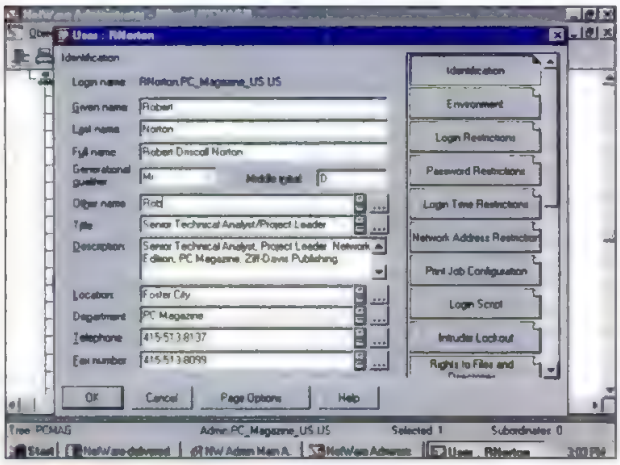
to store multiple copies as well as portions of copies of the directory in separate locations, providing fault tolerance as well as an easy way to cut down traffic over slower WAN links. The different hierarchical views in NDS allow you to look at your directory objects in both logical (organizational) and physical arrangements.

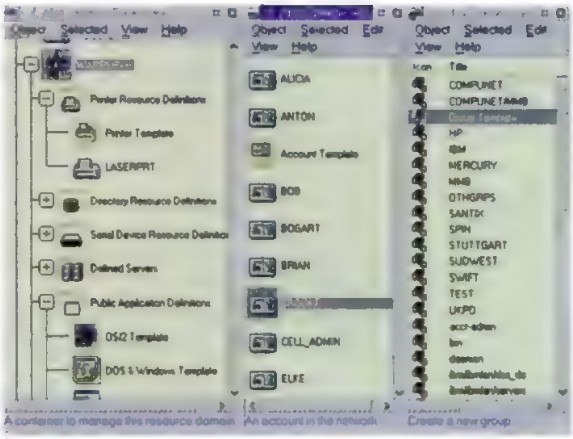
Using NDS is much like accessing a file in Microsoft Windows Explorer. When you start the application, you are presented with a default view, which usually consists of the root of your directory structure. You then proceed to build a directory tree that represents the structure of your organization. Each branch represents a logical grouping of users—either a division, department, or location. You traverse your NDS directory tree by double-clicking on subsections or branches, each of which displays user and resource objects (printers, servers, etc.). When you get to a part of the tree that you want to modify, you can create objects by right-clicking on the Organizational Unit, or branch, in which you want to place the object—selecting Create, and filling in the provided dialog boxes. Later, if you want to move this object to another branch of your tree, you can right-click again for that option.

NDS works very smoothly, but its interface could use a little refinement. For example, when you click on a user object and drag it over a group object, you may think at first that you're adding a user to a group. What you actually are doing in NDS, however, is creating a trustee, or administrator assignment, which gives that user rights to add users or change file-system rights for the members of that group. Novell is currently working on developing Java tools that may provide more intelligence in the near future, but until then you must add users to groups and manually perform the more mundane tasks.



Right clicking on an object *in the NDS directory tree brings up a series of dialog boxes for entering information about the object.*

Another issue with NDS and all other current directory services is that of extensible schemas. NDS ships with a common set of attributes—called the global schema—for every object in the directory structure. For example, Object Name, Password, and Rights to Files and Directories are all fields in the database that are common to all objects. When you install certain NDS-Aware applications, the schema is automatically updated, or extended to include fields that are specific to those products. So if your intention is to provide NetWare Connect services to a select group of people, you will end up adding several new fields to every object in the entire directory tree. Add several applications, each with its own extensions to the global schema, and you may find that directory look-ups start to slow down as they hash through all the added fields to find the information you want.



IBM's DSS administration program *lets you manage users, groups, and resources using a graphical interface, complete with drag-and-drop functionality.*

Standards are the key here, especially if integrating multiple directory services is the goal, but no vendor or standards body has been able to come up with a way to incorporate nonglobal attributes into a global schema.

As of this writing, Novell is working on agreements with the major Unix vendors to distribute NDS for Unix with their shipping NOS products. SCO Unix is already shipping a version of NDS. Other flavors of Unix will get a single server license with each new box in 1997, according to Novell. Administrators can call Novell and, for a small fee, obtain an activation code that will provide full NDS functionality to their existing Unix networks. Novell will also be providing NDS for Windows NT free of charge on the World Wide Web in the near future, and boasts the ability to replace Netscape's Directory Server with a free copy of the more functional NDS product. Major vendors including Oracle have agreed to utilize NDS's APIs to provide authentication services to their NetWare-based products, thereby reducing the total time it takes to write code and release new products.

IBM'S DSS

In 1996, IBM released a family of seven software servers, code-named Eagle, which provide services such as Internet connectivity, messaging, database management, and more to networks incorporating IBM products. As these servers mature, IBM plans to integrate them in such a way that each can take advantage of the services that the others provide. One of the products, Directory and Security Server (DSS) ($3,999 list; IBM Corp., 800-342-6672, *www.software.ibm.com/is/sw-servers/directory*), provides a directory service with security features to multi-platform networks incorporating IBM LAN Server, OS/2 Warp Server, AIX, and Microsoft Windows NT Server, versions 3.51 and 4.0. If you currently have more than one domain with file and print services and want to expand your services to include directory and security services, DSS may be a product you'll want to consider growing into.

DSS's high price and difficult installation—IBM insisted on sending a technician to do the installing, and it still took over a day—may make it prohibitive to smaller organizations. But if your company is large enough, this product can provide the tools to minimize its network administration.

DSS's GUI looks similar to other hierarchical directory service products such as NDS and works in much the same way.

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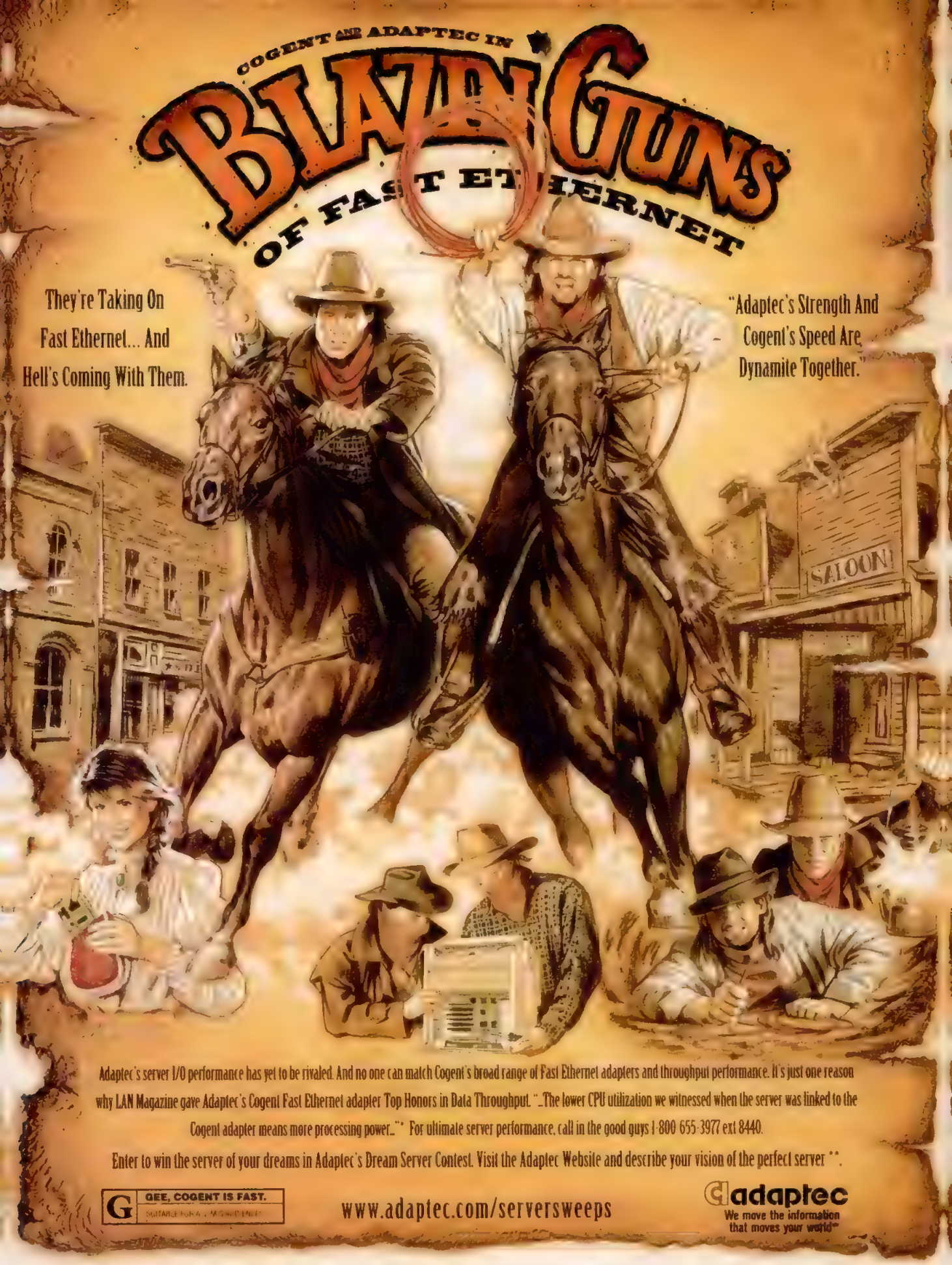

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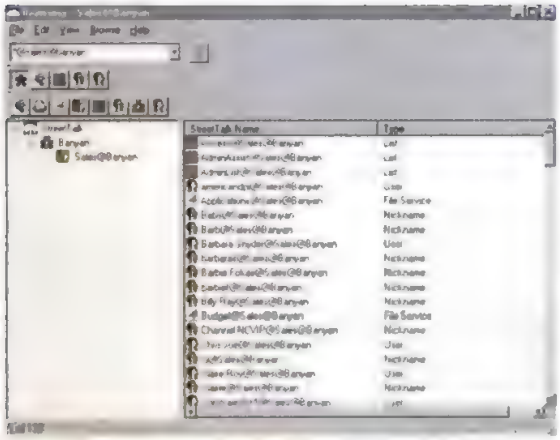

Banyan's StreetTalk for Windows NT *uses a practical naming scheme that limits object names to three parts, such as name@division@organization.*

DSS, however, utilizes DCE (Distributed Computing Environment), a set of services from The Open Group that is meant to allow network applications to be built across heterogeneous platforms. Theoretically, DSS should be able to support applications from other vendors that use DCE, Version 1.1. For the AIX and OS/2 platforms, Windows NT supports the older Version 1.03. Unfortunately, support for DCE is not as widespread as support for LDAP.

One of DSS's advantages over other products such as NDS is the inherent intelligence built into the GUI. If you want to add a user to a group, simply drag that user over the group object and you are done. Drag a user over a file server, and that user gains the ability to use the file system on that server. Another advantage DSS has is its ability to merge trees without having to delete or rename users that have the same name.

BANYAN'S STREETTALK FOR WINDOWS NT

StreetTalk for Windows NT ($2,995 list and up; Banyan Systems Inc., 800-222-6926, 508-898-1000; *www.banyan.com*), a version of Banyan's popular Directory Service that runs on Windows NT Server, Version 3.51 or 4.0, simply ports the VINES operating system to Windows NT and runs as a Windows NT service. As a result, mixed Banyan/Windows NT Server shops can administer both NOSs from a single NT server. StreetTalk for Windows NT also provides basic hierarchical directory services for managing Windows NT–based users and resources.

StreetTalk works somewhat differently from the other products we reviewed. You cannot directly assign an individual user rights to file systems or printers as with NDS. You have to first create and define rights for an Access Rights List (ARL). Then you give those rights to users by adding them to the ARL. All users in an ARL get the same rights. You therefore have to keep careful track of which access rights list or group each user belongs to.

While Banyan boasts that StreetTalk can integrate Windows NT users into StreetTalk's hierarchical directories, we found its abilities in this area basic at best. In order to give Windows NT users access to the StreetTalk directory, you have to make them VINES users and give them VINES clients. To define file systems and print services in StreetTalk, you must first create the services you want in your Windows NT domain, then open up the StreetTalk Explorer, and add a StreetTalk pointer to those existing services.

Banyan Systems doesn't seem to want to go after the big Directory Services pie in the sky. It has no forthcoming plans to turn StreetTalk into the Metadirectory of the future.

DIRECTORY SERVICES TOMORROW

Having moved from single-server solutions to network solutions based on a single NOS or application, vendors of directory services now are faced with the directory management challenges of multi-NOS, multi-application networks, and the Internet. Recent announcements and product introductions have demonstrated three plans of attack: extending existing NOS directory services to support other NOSs, as demonstrated by Banyan Systems' StreetTalk for Windows NT and Novell's NDS for Windows NT and Unix (both of which are discussed in the previous section); making existing services comply with LDAP, so they can communicate directory information with other LDAP-compliant services; and metadirectories—directory services that work with a variety of network operating systems and applications.

For this section we examined two developing directory service tools that reflect these approaches. Netscape Communications Corp.'s Directory Server is a white pages-style application directory service built on LDAP. Zoomit Corp.'s Zoomit VIA is one of the first attempts at a metadirectory. We also look at Microsoft Corp.'s Active Directory, which will be part of Windows NT 5.0 and is its attempt to move from a domain-based service to a hierarchical one.

NETSCAPE DIRECTORY SERVER

Early in 1996, Netscape announced that its SuiteSpot suite of Internet servers would use directory services based on LDAP (See sidebar "LDAP: The Key to the Global Directory?"). Recognizing Netscape's dominant position in the market for Internet-based products, several other vendors, including Microsoft, IBM/Lotus, and Novell followed suit, announcing their own intentions to make their NOS and messaging products LDAP-compliant. LDAP will give these vendors a common protocol for authenticating, searching, and modifying directory entries. One of the six Internet servers in Netscape's SuiteSpot 3.0 server suite ($995 list and up; Netscape Communications Corp., 415-937-2555; *home.netscape.com*), Netscape Directory Server provides general-purpose directory services based on LDAP from the ground up. Netscape doesn't expect to have an LDAP client for its Netscape Navigator browser and new Communicator client until the first quarter of 1997, however.

Netscape provides Directory Server for several versions of Unix, including SGI, IRIX, Solaris, AIX, HP-UX, and Digital, as well as Windows NT Server and Workstation 3.51 and 4.0. You manage the Directory Server with Netscape's HTTP-based Admin server, common to all of Netscape's SuiteSpot servers. Similar to other directory services, you can assign access rights down to the individual branches and leaves of the Server's directory structure—allowing, for example, users to manage their own telephone extension information while restricting them from accessing more critical e-mail addresses.

Directory Server features a flexible replication technique that lets you store information on organizational units on servers in several geographic locations. For example, you could build a server in New York that stores the East Coast organizational units, or branches, and another in San Francisco for the West Coast units. Netscape calls each of these servers Masters. Users who usually access their regional information would get quick performance. Requests for services outside of the

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LDAP: The Key to the Global Directory?

By Robert Norton

In 1988, the Consultative Committee on International Telegraphy and Telephony (CCITT, one of the four subdivisions of the International Telecommunications Union, or ITU) published the X.500 Directory Services standard to facilitate the building of a distributed global directory housing repositories of information such as user names, passwords, photos, locations, and access controls. X.500 was meant to enable the distribution of directory information across the Internet and among applications, letting users search across platforms for white-page information such as e-mail addresses and phone numbers.

Although X.500 provides decentralized management, powerful searching capabilities, and more flexibility than the Internet's Domain Name System (DNS), it has serious limitations. X.500 searches tend to be very slow due to the sheer size of the database—better known as the Directory—and the Directory Access Protocol (DAP), which is the method by which requests are made to the Directory. This is the principal reason that many vendors have decided not to comply with what many consider a perfect-world standard.

Nonetheless, vendors agree that something needs to be done to solve the problems inherent in nonglobal, non-distributed Internet directories. One solution that seems to be on the tip of everyone's tongue these days is LDAP, or Lightweight Directory Access Protocol. Developed in 1993 at the University of Michigan, LDAP is designed to provide access to the Directory while remaining small enough to be implemented widely. LDAP is a subset of DAP, meaning that LDAP can access certain portions of the information stored in the Directory and perform less comprehensive searches.

Products like Web browsers and e-mail packages are expected to have LDAP support, which will enable clients to query LDAP-compliant directories. NOS servers will also eventually support LDAP. In order to be LDAP-compliant, a directory must have the appropriate access protocols to exchange information with querying LDAP clients.

The most significant feature of LDAP is that the protocol elements are carried directly over TCP or other transport layer protocols, which bypasses much of the session and presentation overhead. Also, many of the protocol data elements, such as distinguished names, are encoded as ordinary strings. This also lessens the overhead of the protocol.

LDAP is meant to be the key to truly comprehensive, distributed global directories. Vendors who have agonized over developing user directories and security access protocols for their products may now be able to spend much less time on the directory drawing boards and more time and money perfecting the core of their applications.

The issue now is whether LDAP is another perfect-world standard to which no one will adhere. Detractors predict LDAP will meet the same fate as X.500, but at least 44 vendors including Banyan, IBM, Microsoft, Netscape, and Novell have announced that their products are, or soon will be, LDAP-compliant.

One thing is certain: For any directory services standard to become truly globally accepted, it must become a usable implementation-ready tool for developers. This will lessen the burden of developing applications that require directory services.

region would be referred to the other Master. In this way Directory Server can meet the administrative and access needs of large, decentralized organizations. Directory Server also lets you combine Masters into larger read-only replicas that can be combinations of any or all Master directories. By accessing these read-only replicas, users can get a map of the entire directory.

The extensible directory structure of Netscape servers lets you add your own keys or fields. This flexibility is nice, but it can be a potential hindrance to making LDAP a standards-based directory service since LDAP 2.0 is incapable of interpreting unknown schema. Initially, Netscape is hoping to take the middle ground by providing a schema based on the X.500 Person document.

ZOOMIT VIA

While Netscape provides a directory service based on standards, Zoomit VIA ($1,500 list and up; Zoomit Corp., 800-565-5156; *www.zoomit.com*) is a metadirectory that attempts to centralize the management of nonstandard directory services in order to bring some cohesiveness to an organization's existing directory structure.

Zoomit VIA is designed to consolidate existing proprietary directory information into a single directory. With a single master directory, users and applications can have access to a broad range of information and systems, and administrators can spend less time keeping a dozen directory services in sync.

We managed to get a preliminary look at a beta version of Zoomit VIA, though we didn't have time to thoroughly experiment with it for this feature. Zoomit's master metadirectory has an X.500-like structure that uses distinguished names, and a path-like structure made up of organizational units, organizations, and countries. This structure also describes resources, such as printers, conference rooms, or computers. The metadirectory server, which runs on Windows NT Server or Workstation 3.51 and 4.0 or Windows 95, can accumulate directory information from a variety of proprietary directory services, including those contained in Lotus cc:Mail, Lotus Notes, Microsoft Windows NT Server, Microsoft Exchange, Novell's NetWare Bindery (an agent for NDS should be available by the time you read this), Novell's GroupWise 4.1, and Banyan Systems' VINES 5.54. Zoomit VIA uses Management Agents specific to each directory service type to exchange information between the metadirectory server and the proprietary servers.

Zoomit VIA's metadirectory structure is very flexible, letting you make changes at the source directory—Windows NT domains, for example—or at the metadirectory level. So, you can let the Windows NT Server administrators in Paris maintain their own directory information using Windows NT Server's tools while you manage all of the Notes mail, cc:Mail, and Exchange directories in New York using VIA's tools. VIA will register all changes from Paris and New York in its metadirectory.

Users and other applications talk to the directory with an LDAP client—supplied by Zoomit—called Zoomit Compass. Compass runs on all Windows platforms. Users can use Compass to perform general white-pages lookups of user information, while administrators use Compass as their management interface to the metadi-

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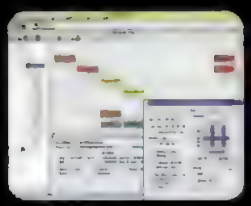

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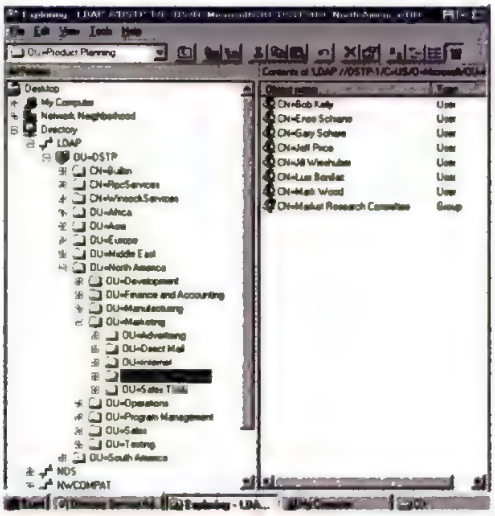


With Microsoft's Active Directory, *Windows NT 5.0 will make the move to a full hierarchical directory service similar to NDS.*

rectory. The VIA server also includes an HTTP web server so users can access directory information with a typical Web browser such as Netscape's Navigator or Microsoft's Internet Explorer.

Zoomit VIA comes with a series of tools to help with migration and customization and a forms designer tool that lets you customize the Compass client's interface.

MICROSOFT ACTIVE DIRECTORY

Attempting to move Windows NT out of its flat, domain architecture into a hierarchical one, Microsoft recently announced its Active Directory Services, which will be included in Windows NT Server, Version 5.0 (Microsoft Corp., 800-426-9400, *www.microsoft.com/msdn/sdk/platforms/doc/oleds/src/dsintro-1.htm*). While it will have a proprietary structure, Microsoft Active Directory will support LDAP as a communications protocol for exchanging information with other directory services such as Novell's competing NDS.

Active Directory lets organizations manage multiple domains within a single hierarchical tree. Similar to Microsoft Exchange's directory structure, the Active Directory's schema will be extensible, allowing administrators to customize the directory structure.

Facilitating interconnectivity between Windows NT and other directory services is a new Active Directory Service Provider Interface (SPI) based on Active X. Microsoft and third-party developers will be able to plug in SPIs, much like printer drivers—allowing them to manage other directory services, such as NetWare's NDS or Bindery, from an NT Server or Workstation.

Administrators will be able to manage the Active Directory from Microsoft's new Management Console running on Windows NT or Windows 95 or via a Web browser.

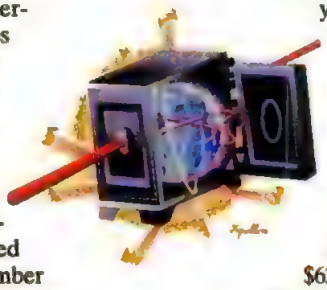
Whether it's through metadirectories, standards-based LDAP, services, or a reworked proprietary Windows NT directory, directory services are coming together in ways that will allow administrators to expand their existing services into the Internet and intranet, while taking advantage of the reliability and power of their existing proprietary application and NOS directory services. □

MULTIPLE ACCESS By Steve Buehler

That's Your Problem

I've often wanted to say that to my network users. Somehow, they think the network manager is responsible for everything from keeping the network up to helping them learn HTML. In most cases, you smile politely, because—after all—it is your job to serve the users. But one place where you can tell users that it's not your job is personal backup. Several products and services are now available to do backup over the Internet, and you can implement this so the burden is shifted from you to the user.

More than a year ago, I mentioned XactLabs (*www.XactLabs.com*), which developed technology in its Atreiva product to compress, encrypt, and keep data off-site for you to recover whenever you wanted ("Set and Forget," Network Edition, December 5, 1995, page NE36). Several other companies have joined this market, and each of their products has interesting features. McAfee (*www.mcafee.com*), long known for virus and network management tools, has released Personal Vault, which works with its WebStor product to help users figure out what's worth protecting and what isn't. Another possibility is from Surefind Information Service (*www.surefind.com*), which does the same thing but is hosted over the CompuServe network. A third comes from HotWire (*www.hotwire.net*), which lets you keep data either on its off-site server or on a server on your network. And recently, a Silicon Valley startup, Tuneup.com (*www.tuneup.com*), began its DataGarage service along with its core-software update product. Some of these products are more home-oriented than XactLabs, but the network administrator's responsibility for mission-critical data obviously doesn't go away. You get to keep backing up your accounts receivables and sales histories, but with these products at least you won't also have to hold users' hands for their personal stuff.



If this concept seems good to you, you have yet another option. If you're in a highly secure environment, or if you're suspicious of sending any data—no matter how well-encrypted—to an outside site, then you can take this whole process inside. IBM (*www.storage.ibm.com*) offers its 3466 Network Storage Manager, which is a huge, automated tape-library with a RISC processor that supports IBM's Java-enabled WebShell client. With up to 144 gigabytes of disk to cache data before writing it to tape, and 40 terabytes of tape storage, this box—ranging in price from $500,000 to $620,000—is a high-powered solution. Put it in your glass house, and you can let users back up and recover their files while keeping everything under lock and key.

These products are part of a trend I see developing toward giving users tools to make their lives easier. With these products, you can offer users the capability, the responsibility, and the authority to do their own backups. When they realize they can be a big part of the solution, they may take on the ownership to set their own levels of service for backing up and restoring without getting you and your support staff involved.

ILLUSTRATION BY CHRIS SPOLLEN

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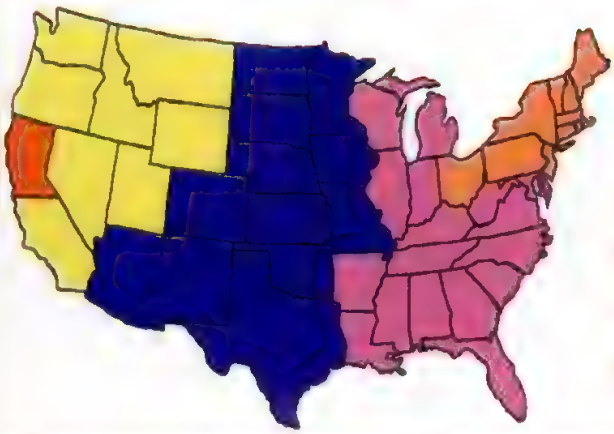

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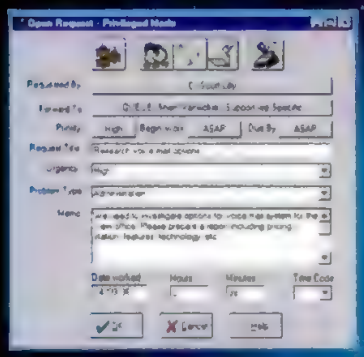
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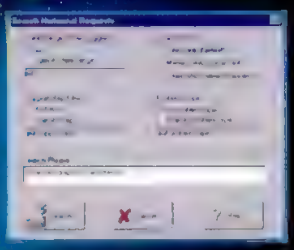
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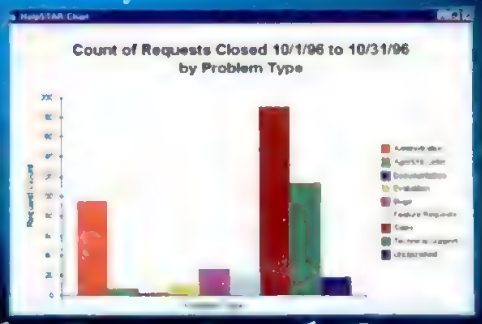

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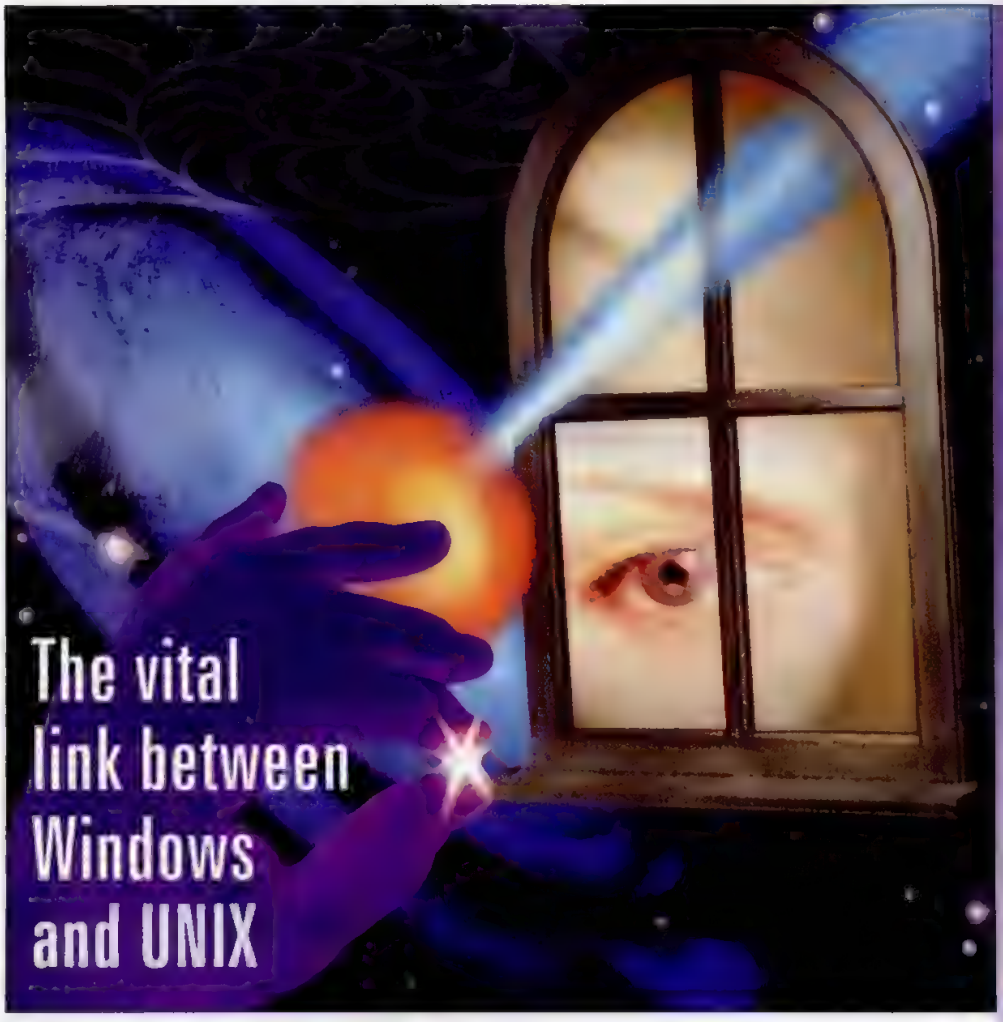

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PHOTOGRAPH BY MERT KERIM

Notebook PCs

Today's value notebooks have many features of yesterday's high-end units. The result: reasonable power with enough frills to keep most users productive.

By Robert S. Anthony

SMART LITHIUM ION BATTERY. Lithium ion batteries are more expensive and in shorter supply than nickel hydride packs, but they usually give about an hour more of life per charge.

DESKTOP-LEVEL COMPONENTS. You'll be pleasantly surprised by just how much power can be had in a "value" notebook—everything from 133-MHz and faster Pentium CPUs to EDO DRAM and even pipelined-burst L2 cache.

Buying a "fleet PC" for your company is no easy task. The system you choose must satisfy the needs of many, provide enough power and a rich enough feature set to keep it from becoming obsolete in six months, and fit into a budget. If anything, the notebook is more difficult to fit within this paradigm than the desktop: Since notebooks have traditionally lagged behind in features and performance, any one you choose may seem obsolete. Notebooks also carry a price premium over similarly equipped desktops, as manufacturers must fit the same components into smaller packages.

What may make your task even harder is knowing about the wealth of features you can now find in notebooks. A quick run through any computer store will show you what's available: huge displays, muscular CPUs, big hard disks, and enough bells and whistles to make your head spin. But flip over the price tags and you'll find that many notebooks with these big-gun features are more affordable than you think. That's because many vendors

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now realize that a sizable group of potential customers cannot afford expensive machines. So they offer value notebooks: affordable systems that provide the basic requirements of mobile computing and a little bit more.

It's interesting to keep track of notebook features as they trickle down from last year's top-of-the-line models to today's value systems. When we set the price limit for this roundup—$3,000 for systems with CD-ROM drives and $2,750 for those without—we expected to receive spartan units a few steps behind the top-level notebooks we reviewed last summer ("Portable Property," August 1996). After rounding up 27 value-priced Pentium notebooks, however, we realized that "a little bit more" can add up to an awful lot.

REVIEW CRITERIA

Some of the requirements for this roundup of budget notebooks were more stringent than those for our August 1996 roundup of high-end ("presentation") units. For this story, we required each unit to observe a price ceiling. (Late in our test cycle we found that two, the AMS TravelPro 185CT and the Dell Latitude LM P-133ST, exceeded the limit by a few hundred dollars. Both remain in this roundup for comparative purposes, though.) Each system also had to have a Pentium-class CPU, 16MB of RAM, a hard disk with a capacity of at least 810MB, a color display supporting a resolution of at least 800 by 600 pixels, and a preinstalled copy of Windows 95. An internal CD-ROM drive (fixed or modular) was optional. For our August 1996 story, we did not set a firm price limit, and we required only a 720MB hard disk and a top internal display resolution of only 640-by-480 or higher.

RECENT REVIEWS

▶High Style, High Speed
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▶Choose Your 200
December 3, 1996.....*Page 100*
40 Pentium Pro/200 PCs and 51 Pentium/200 and Cyrix 6x86-P200+ PCs.

▶Portable Property
August 1996.....*Page 100*
58 Pentium-class notebooks.

SO WHAT DO YOU GET?

Until recently, the mere thought of a Pentium/150 or Pentium/166 CPU in a sub-$3,000 notebook would have elicited a lot of laughter from a PC salesperson. In this roundup, however, two units with these high-powered CPUs—the $2,695 Astro PowerMedia III Plus (Pentium/166) and the $2,999 BSI NP8625A (Pentium/150)—managed to make our price ceiling.

To put this in perspective, note that our August 1996 roundup did not include any Pentium/166 units and that the least expensive Pentium/150 notebook was Broadax's $3,765 BSI NP5265A. Most of the units in the present roundup used lesser Pentiums: the Pentium/133 (13 systems), the Pentium/120 (9 systems), and even the Pentium/100 (3 systems), which has all but disappeared from desktops.

Surprisingly, the best performers on our Business Winstone 97 benchmark test program were not the units with the most powerful CPUs. In fact, the Pentium/150 and Pentium/166 machines barely broke into the top five. The top Business Winstone 97 score, 28, was posted by the $2,999 ARM-Note TS96CD and the $3,199 Dell Latitude LM P-133ST, both of which use the same Pentium/133 motherboard.

Although Twinhead's Pentium/100-based Slimnote 710CV ($2,019) posted the lowest Business Winstone 97 score (16), it is built for portability, not power. With just a 6.2-pound travel weight (a measure that includes the battery and the transformer), it is the lightest system in this roundup by over half a pound. (Its closest competitor is IBM's ThinkPad 365X, with a travel weight of 6.8 pounds).

Speaking of heft, this roundup suggests that some notebook users may be willing to trade off a little extra weight for a low price. Seven of the units reviewed have a travel weight of over 9 pounds, a bit much

VALUE NOTEBOOKS

How to Read the Ratings Boxes

SUITABILITY TO TASK

Product name

Desktop replacement	Good
Road warrior	Excellent

SERVICE & RELIABILITY

Company name

Reliability	Worse than average
Repair	Average
Technical support	Better than average
Percent needing repair	Better than average

Suitability to Task

Scores reflect how well a product can perform a particular function or operation. Product price is not a factor. The possible ratings are *excellent, good, fair,* and *poor.*

The **desktop replacement** rating reflects the ability to substitute for a desktop PC, considering screen resolution, size, and performance.

The **road warrior** rating reflects the notebook's aptitude for prolonged use on the road. Key factors include battery life, travel weight, performance, screen size, keyboard, and integrated fax modem.

Service & Reliability

We rate vendors that received at least 50 responses on our latest Service and Reliability survey of 17,000 subscribers. The data is analyzed using a *t-test,* a standard procedure for identifying differences from the average that are significant at the 95 percent confidence level. For details, see our July 1996 issue, page 212.

The **reliability** rating is a measure of respondents' satisfaction with the reliability of the vendor's desktops in use over the past two years.

The **repair** rating is a measure of respondents' satisfaction with the vendor's repair service for PCs in use over the past two years.

The **technical support** rating measures respondents' satisfaction with the vendor's support for PCs in use over the past two years.

The **percent needing repair** rating is a measure of the proportion of desktops that the respondents indicated needed repair during the past year. *Better than average* means that the incidence of needed repairs is significantly lower than average.

Editors' Choice

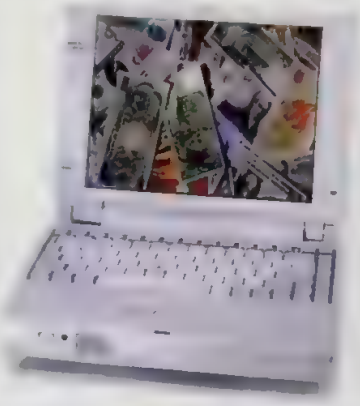
• Toshiba Satellite Pro 430CDS

PC MAGAZINE EDITORS' CHOICE

We were amazed with what you can buy for less than $3,000—everything from 11-inch-plus displays to fast Pentium CPUs and 1GB and larger hard disks.

In this diverse pack of 27 value notebooks, we found one that stands apart: the $2,500 Toshiba Satellite Pro 430CDS. One look at the Satellite Pro's spec sheet and you'd think you were buying a desktop PC. It features a 1.3GB hard disk, a 10X (yes, *10*X) CD-ROM drive, and a Pentium/120 CPU. Toshiba also packs an 11.3-inch dual-scan Super VGA display and an integrated AC adapter into the unit's 7.3 pounds (travel weight). There's even a connector for the external floppy disk drive, so you can use it and the CD-ROM drive simultaneously. And you won't be disappointed with this lithium-powered PC's battery life: The system logged nearly 2.5 hours on our BatteryMark test.

The Satellite Pro was no performance slouch. Its great test scores are a testament to the unit's ability to integrate and tune notebooks for optimal performance, because the Satellite Pro has *no* L2 cache; other cacheless units suffered big performance hits, but the Satellite Pro seemed unaffected. Toshiba also received a grade of A on our most recent Service and Reliability survey.



We were also impressed with the $2,999 WinBook FX, and we award it an honorable mention. This lithium-powered notebook's best feature is its battery life: It ran for almost 4 hours on our BatteryMark test. This result is amazing, given that the WinBook runs on a Pentium/133 CPU and features an 11.3-inch active-matrix display.

We liked the Dell Latitude LM P-133ST, too. Unfortunately, at $3,199 (direct), it exceeded our price limit, although the vendor does sell the same notebook with an 810MB hard disk for $2,999. (Several other units also exceeded our price limit, as we learned belatedly.) But if you have the extra cash, the Latitude is a great buy. Featuring a Pentium/133 CPU; NeoMagic's cutting-edge, 128-bit MagicGraph 128 graphics accelerator; and a 1.3GB hard disk, it was a top performer. It also has a 12.1-inch active-matrix display, a 6X CD-ROM drive, and a lithium ion battery, which lasted 3 hours on our BatteryMark test. The same notebook is sold by ARM (the ARMNote TS96CD) and by Sceptre Technologies (the SoundX S4000T). We recognize Dell over the others mainly because of its superior notebook service-and-support program, which earned it a grade of B on our Service and Reliability survey.

Both the $2,999 ARMNote and the $2,995 Sceptre SoundX S4000T are good performers, and each has the same screen and CPU as the Dell Latitude. But the SoundX has a smaller hard disk—a Toshiba 776MB model—while the ARMNote's hard disk, a 1.3GB Maxtor unit, was comparable to that of the Dell unit. The battery life of the SoundX was shorter as well, at 2:38, while the ARMNote's battery life, at 2:53, was nearly the same as the Dell's.

for frequent traveling. Take Broadax Systems' BSI NP8625A: Although it has a 6X CD-ROM drive, a 12.1-inch active-matrix display, and a Pentium/150 CPU in its favor, it saddles the user with a travel weight of 9.3 pounds.

MULTIMEDIA BARGAINS

This roundup makes it clear that a CD-ROM drive is no longer the sign of an expensive notebook. Only 3 of the 27 systems here came without this feature.

Setting the pace in CD-ROM performance is our Editors' Choice, Toshiba's $2,500 Satellite Pro 430CDS. It is the only tested unit with a 10X CD-ROM drive. All of the others came with 6X drives, except the $2,570 HP OmniBook 5500CS, which had a 4X drive.

Hard disk capacity is also not a problem in this price range: Only five units had hard disks with capacities of less than 1GB. The BSI NP8625A even offered a 2GB model.

Audio subsystems, once limited to presentation and multimedia notebooks, have completely saturated the value class. Among the units we review, only the $2,400 Compaq Armada 1130T lacks this feature. (The Compaq Armada 4130T—covered in the sidebar "The Great Subnotebook Road Test"—does have audio, as does Compaq's flagship notebook, the Compaq LTE 5000.)

BIGGER AND BETTER DISPLAYS

Finding a large LCD panel in this price range is not difficult. Only 5 of the reviewed systems have displays smaller than 11 inches (measured diagonally), and 12 units offer 12-inch or larger screens.

Two years ago, only the most expensive notebooks had active-matrix displays, but here we find that 19 out of 27 value units offer such screens (the other 8 use less expensive, dual-scan displays).

A dual-scan panel is split into two sections that refresh simultaneously, thus halving the time the unit would otherwise take to refresh the screen image. Dual-scan panels can thus resemble active-TFT panels in terms of response time and refresh rate. And though dual-scan screens do not offer the same rich colors and wide viewing angles as active-matrix panels, many of those seen here come extremely close. They are also much cheaper than active matrix, as high demand for the latter has increased the price delta. The days of the washed-out dual-scan display, with wide, dark scan lines cutting through the center of your viewing area, are gone.

The clear winners on our Business Graphics WinMark 97 tests were four systems that used NeoMagic's MagicGraph

Our Contributors ROBERT S. ANTHONY is a senior writer for *PC Magazine*. CADE METZ is a staff writer, BRUCE BROWN is a contributing editor, and NICK STAM is a technical director of *PC Magazine*. CAROL VENEZIA was the senior associate editor in charge of this story, and CHARLES RODRIGUEZ was the project leader.

PHOTOGRAPHS BY THOM O'CONNOR

Price Blitz

The Multimedia **WinBook XP5 Pro** *for only*

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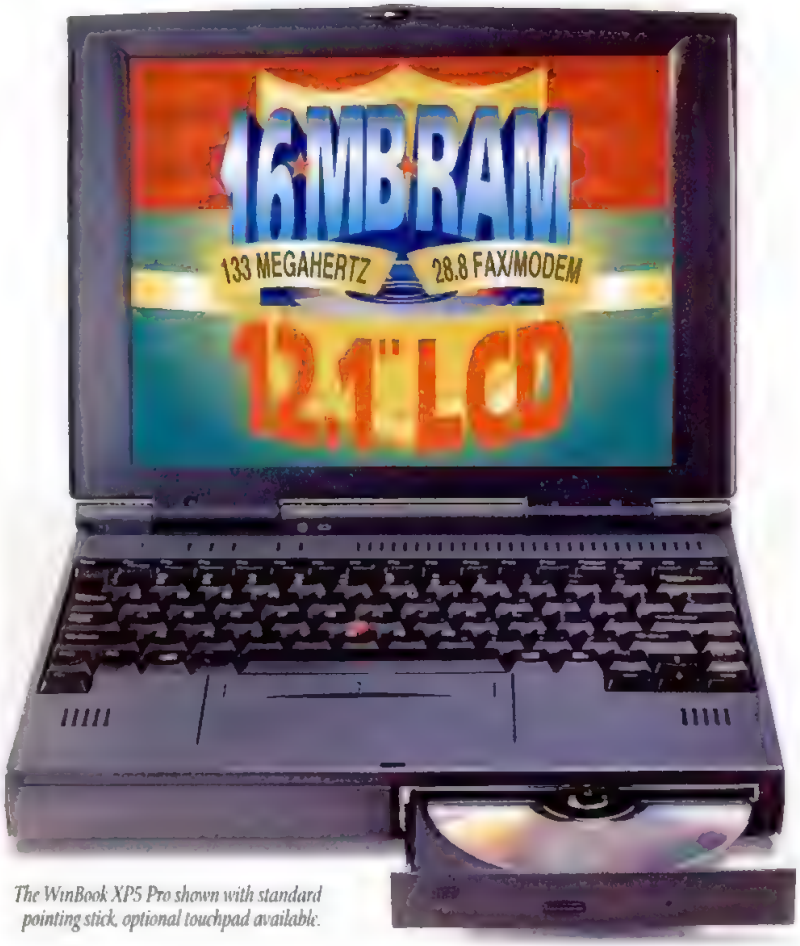

The WinBook XP5 Pro shown with standard pointing stick, optional touchpad available.

WinBook *XP5Pro*

- 133MHz Intel® Pentium® Processor
- 12.1" Dual-Scan Color Display
- 1GB removable Hard Drive
- 16MB EDO RAM expandable to 40MB
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April 1995, WinBook XP Best Value 486DX4 Notebook

January 1996 PC Laptop Editor's Choice – WinBook XP, XP5

March 1996 Windows 5 of 5 Rating WinBook XP5

April 1996 WinBook XP5 P120 16/1.3GB Active Matrix

Laptop Buyer's Guide May 1996, WinBook XP5 P120 16/1.3GB TFT

June 1996, WinBook XP5 P120 16/1.3GB Active Matrix

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August 1996 PC Magazine Editors' Choice WinBook XP5 P100

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Making Sense of the Clones

Since manufacturing a notebook PC can be an excessively expensive venture, many U.S. PC vendors contract Taiwanese and other companies to build notebooks for them. Below is a breakout of some of the notebooks we saw in this roundup that are offered by more than one vendor, with key specifications to help you make a buying decision. (Note that each of the units listed below includes a 6X CD-ROM drive.)

Original manufacturer	Reselling vendor	Product name	Processor	Screen	Hard disk capacity	Warranty	Price
Chicony Electronics	Chem USA Corp.	ChemBook 9750	Pentium/133	12.1-inch active-matrix	1.3GB	1 year parts and labor. No on-site service.	$2,960 (street)
	FutureTech Systems Inc.	FutureMate OHP	Pentium/133	10.4-inch active-matrix	1.3GB	1 year parts and labor. No on-site service.	$2,929 (direct)
	Wedge Technology Inc.	Showbiz-5000	Pentium/100	10.4-inch active-matrix	1.3GB	1 year parts, 3 years labor. On-site: first year, $299.	$2,600 (street)
Dual Enterprises Corp.	All Computer Technology	ACT ND5123TE	Pentium/133	12.1-inch active-matrix	1.3GB	1 year parts and labor. No on-site service.	$2,998 (direct)
	Astro Research Inc.	PowerMedia III Plus	Pentium/166	12.1-inch active-matrix	1GB	1 year parts and labor. No on-site service.	$2,695 (direct)
Full Power Investment Co.	ARM Computer Inc.	ARMNote TS96CD	Pentium/133	12.1-inch active-matrix	1 3GB	1 year parts, 3 years labor. On-site: first year, $260 top.	$2,999 (direct)
	Dell Computer Corp.	Latitude LM P-133ST	Pentium/133	12.1-inch active-matrix	1.3GB	3 years parts, 1 year labor. On-site: first year, $99.	$3,199 (direct)
	Sceptre Technologies Inc.	SoundX S4000T	Pentium/133	12-inch active-matrix	776MB	3 years parts and labor. No on-site service.	$3,000 (street)
Nan Tan Computer Co.	Broadax Systems Inc.	BSI NP8625A	Pentium/150	12.1-inch active-matrix	2GB	1 year parts and labor. No on-site service.	$2,999 (direct)
	DFI Inc.	DFI 6620	Pentium/133	12.1-inch active-matrix	1GB	1 year parts, 3 years labor. No on-site service.	$2,999 (direct)
	DTK Computer Inc.	DTK DTN-5A120C-2M	Pentium/120	10.5-inch active-matrix	1.3GB	1 year parts and labor. No on-site service.	$3,000 (street)
	Micro Express	Micro Express NP133B	Pentium/133	12.1-inch active-matrix	1.3GB	2 years parts and labor. No on-site service.	$2,699 (direct)
	Mobile Office Systems	Mobile Office MOS8600CDT	Pentium/133	10.4-inch active-matrix	1GB	4 years parts and labor. On-site: first year, $185.	$2,795 (direct)
Quanta Computer Inc.	Gateway 2000 Inc.	Solo 2100-120	Pentium/120	11.3-inch dual-scan	774MB	1 year parts and labor. No on-site service.	$2,594 (direct)
	WinBook Corp.	WinBook FX	Pentium/133	11.3-inch active-matrix	776MB	1 year parts and labor. No on-site service.	$2,999 (direct)

128-bit graphics accelerators. The $3,000 Sceptre SoundX S4000T, the $3,199 Dell Latitude LM P-133ST, the $2,999 ARMNote TS96CD, and the $3,330 AMS TravelPro 185CT left the rest of the field in the dust.

A unique unit in this roundup was the $2,929 FutureMate OHP, from FutureTech Systems. Undo a few latches and the back of the display housing comes off to expose the translucent 10.4-inch active-matrix LCD panel, which you can then place atop an overhead projector. The unit comes with a collapsible stand and with a cooling fan to prevent the LCD panel from overheating.

ENERGIZED FOR THE LONG HAUL

Lithium ion battery technology has grabbed a solid foothold among value notebooks. Lithium ion batteries have a higher power density (more muscle per ounce) than nickel hydride batteries but are also more expensive and in much shorter supply. Eleven notebooks here are equipped with them.

WinBook Corp.'s $2,999 WinBook FX, which has a lithium ion battery and a Pentium/133 CPU, posted the best time on our BatteryMark test—3:52. The average system lasted 2:01.

SO WHAT'S MISSING?

Although these value notebooks offer a lot for the dollar, there are some features you simply can't get without paying quite a bit for (not yet, that is). The Compaq Armada 1130T, one of the lowest-priced units here, illustrates what penny pinching will buy you. For $2,400 (street price) you get a Pentium/120 CPU, a 1GB hard disk, and a 10.4-inch active-matrix display, but you don't get external processor cache, audio support, or a CD-ROM drive.

Though a number of vendors now offer units with 1,024-by-768 displays, there were no such systems in this roundup. This is hardly surprising, since the lone 1,024-by-768-capable notebook in our August 1996 roundup, the Toshiba Tecra 720CDT, was priced at $6,299—more than double the limit for this story. Prices for notebooks with 1,024-by-768 displays have dropped since then, but not far enough to fall into our value category. We also feel that 1,024-by-768 display sizes must increase to at least 13 inches before such a high resolution can be readable. At 12.1 inches (measured diagonally), the Tecra's screen is difficult to read at 1,024-by-768 level.

CACHING OUT

Some vendors keep their value notebooks' prices as well as the heat dissipation down by doing without external processor (L2) cache. In this roundup, we saw cacheless notebooks from AST, Compaq, IBM, NEC, Texas Instruments, Toshiba, and Twinhead.

All of these units except the AST Ascentia A41 tried to make up for this by using EDO DRAM. In most cases, however, the absence of cache resulted in very low benchmark test scores. The Editors' Choice–winning Toshiba Satellite Pro 430CDS was the exception: It performed well against its competition, a fact that testifies to Toshiba's expertise in building notebook PCs.

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MIRROR IMAGES

If some of the units here look similar, there's a good reason. Eleven use one of four motherboards from four Taiwanese manufacturers (see the sidebar "Making Sense of the Clones"). These manufacturers are Chicony Electronics Co. (in the ChemBook 9750, the FutureMate OHP, and the Wedge Showbiz-5000), Dual Enterprises Corp. (in the ACT ND5123TE and the Astro PowerMedia III Plus), Full Power Investment Co. (in the ARMNote TS96CD, the Dell Latitude LM P-133ST, and the Sceptre SoundX S4000T), and Nan Tan Computer Co. (in the BSI NP8625A, the DFI 6620, the DTK DTN 5A120C-2M, the Micro Express NP133B, and the Mobile Office MOS8600CDT).

LATE ARRIVALS

After our deadline for this roundup, Compaq shipped a new Presario line of home PCs, which included portables. The units mimic Presario desktops by providing exterior CD-ROM control buttons; on the notebooks, they are available even when the units are closed. The first units include the $2,499 Presario 1010 (Pentium/120, 810MB hard disk, 11.3-inch dual-scan display) and the $2,799 Presario 1020 (Pentium/120, 1GB hard disk, 11.3-inch dual-scan display).

Zenith Direct also offers a new Pentium/133-based notebook, the $3,449 Z-Note GT. This machine features a 12.1-inch active-matrix display, a 1.3GB Toshiba hard disk, a 6X CD-ROM drive, and a 28.8-Kbps modem.

UP NEXT: MMX

In the beginning of January, Intel was to have announced its new Pentium CPU (code-named the P55C), which uses MMX Technology. This CPU incorporates 57 new instructions above the existing *x*86 instruction set, geared toward boosting the performance of multimedia applications, such as those using audio or motion video. The chip also carries double the L1 cache of existing P54C Pentium processors (32K rather than 16K).

In an unprecedented move, Intel will announce both desktop and mobile (that is, low-voltage) versions of the chip simultaneously. In the past, introductions of new mobile Pentiums have lagged behind desktop chip announcements by at least six months. But don't expect to find these CPUs in value notebooks soon. They will likely be in short supply at first, and they should be more expensive than standard P54C mobile Pentiums, so vendors will reserve them for their high-end notebooks.

CHEAPSKATES' COMPANIONS

The notebooks here require you to do without a few frills, but you can find many that will put your vintage Pentium desktop to shame. With notebooks, you still get what you pay for, but this roundup proves that a little goes a long way.

All Computer Technology

ACT ND5123TE

All Computer Technology's $2,998 (direct) ACT ND5123TE posted competitive test scores within its CPU class; only a short battery life hampers the unit. Targeted at a broad range of users, the Pentium/133-based ACT notebook offers crowd-pleasing hardware, such as a 12.1-inch active-matrix display and a 1.3GB hard disk.

The 9.3-pound (travel weight) ACT ND5123TE used a SiS chip set, 256K of pipelined-burst L2 cache, and EDO DRAM, which kept its CPUmark$_{32}$ scores within the average range. The Toshiba hard disk and the 6X CD-ROM drive posted average and above-average scores, respectively. The unit lasted a disappointing 1:22 on our BatteryMark test with the standard nickel hydride battery.

A graphics engine (Chips & Technologies CT65550) with 2MB of VRAM runs the Super VGA display with 64,000 colors, and SRS 3-D sound is built into the system for enhanced audio. The system also features an unusual option: a 230MB Fujitsu magneto-optical drive ($498 direct), which is interchangeable with the CD-ROM drive.

SUITABILITY TO TASK

ACT ND5123TE

Desktop replacement	Good
Road warrior	Fair

The ACT ND5123TE doesn't run for long away from an AC outlet, but otherwise it's a good general-purpose notebook for users who want near-desktop-level performance.—*Bruce Brown*

ACT ND5123TE. Direct price: $2,998. All Computer Technology, City of Industry, CA; 800-775-1953, 818-369-4181; fax, 818-961-7462; www.allcomp.com/acw. *Circle 441 on reader service card.*

AMS Tech

TravelPro 185CT

AMS Tech's TravelPro 185CT is impressive, but at $3,300 (street), it's the highest-priced notebook in this roundup. This Pentium/120 portable offers a 12.1-inch active-matrix display, a 128-bit graphics subsystem, a 6X CD-ROM drive (purchased separately but included in the price quoted here) that can be swapped with the floppy disk drive, and it achieved noteworthy test scores. You can also use the floppy disk drive externally for simultaneous operation with the CD-ROM drive.

SUITABILITY TO TASK

Travel Pro 185CT

Desktop replacement	Good
Road warrior	Good

Travel weight is 7.6 pounds. A NeoMagic MagicGraph128 graphics accelerator contributed to above-average scores on our Graphics WinMark 97 tests. A below-average Disk WinMark 97 score resulted in part from the 4,200-rpm 1.3GB Hitachi hard disk, but the unit turned in an above-average Winstone 97 score and an average CD-ROM WinMark 97 score. Its smart lithium ion battery lasted 3:02 on our battery test.

The TravelPro also offers a PC Card bay, a thumbwheel volume

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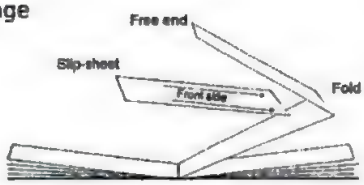

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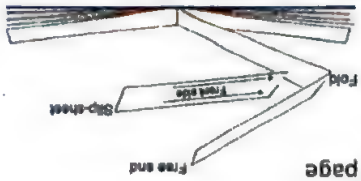

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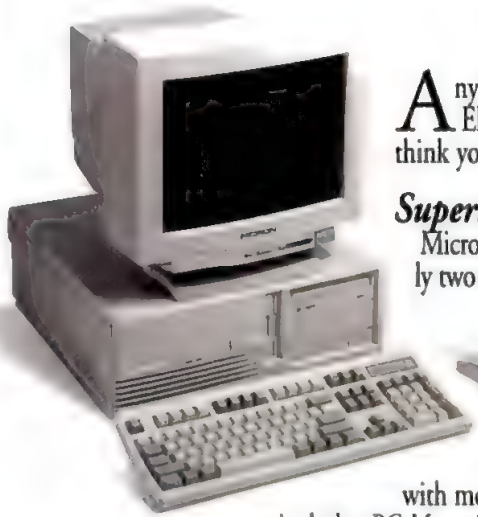

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- 3Com 3C905-TX Fast EtherLink PCI 10/100-base-TX
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- 2 type II or one type III PCMCIA slots
- S-video and NTSC-video outputs
- Headphone, microphone and line-in jacks
- 2 infrared ports, one front, one back
- Parallel, serial, VGA and 2 PS/2® ports
- Dimensions: 11.7" x 9.4" x 2.0", weight: 6.9 lbs.†
- Nylon carrying case
- Microsoft® Windows® 95 and MS® Plus! CDs
- Microsoft Office Pro 95 and Bookshelf® 95 CDs
- Kensington™ security lock ready††
- 5-year/3-year Micron Power™ warranty

† 6.9 lbs. includes 3.5" floppy and one battery
†† Lock secures both Kensington TransPort and MicronDock

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- 32MB EDO RAM (48MB max.)
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- 1.3GB removable hard drive

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- 48MB EDO RAM
- 12.1" active matrix color display, 800x600
- 2.1GB removable hard drive

$4,399 Bus. lease $150/mo.

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- With MicronExec™ desktop package ..... add $799
- With car adapter ..... add $89
- With 3Com® ethernet 10BT PCMCIA ..... add $149
- With Samsonite leather bag ..... add $99

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Price/Performance Index: Value Notebooks

This crop of value notebooks offers some extremes in terms of bang for the buck. In some cases, a comparatively low price translated into fewer features and lesser performance. Our Editors' Choice unit, however, the $2,500 Toshiba Satellite Pro 430CDS, is an exceptional machine.

The clear leader on the price/performance scale, the Pentium/120-based Satellite Pro delivers many features that you wouldn't expect in a value notebook, including an integrated AC adapter, Zoomed Port Video support, and a 10X CD-ROM drive. Toshiba backs this notebook with an exceptional service and support plan, which readers appreciated in our most recent Service and Reliability survey, in which Toshiba earned a grade of A.

Dell's $3,199 Latitude LM P-133ST takes up where the NP133B leaves off, but it comes with a higher price tag. For the extra $500, it offers a slightly bigger 1.3GB hard disk, a three-year-parts and one-year-labor warranty, and a lithium ion battery that lasted 3 hours on our BatteryMark test. The whole package has a 7.7-pound travel weight, and its performance consistently placed it among the top three of all machines tested in this roundup.

The $2,999 WinBook FX has many of the same strengths as the Dell unit and boasts the longest battery life in this roundup: 3 hours 52 minutes on our BatteryMark test. Though many of its features and performance are comparable with the Dell's, its warranty is one year, its travel weight (8.4 pounds) is a bit heavier, and its screen size (11.3 inches) is a bit smaller.

The Pentium/120-based Compaq Armada 1130T is noteworthy for a very different reason: its bargain-basement price of $2,400. This is a no-frills unit, however, with no L2 cache, a nickel hydride battery, and no sound (it's the only unit here without this feature), and it also lacks a CD-ROM drive.

On the up side, the Armada does have a 7-pound travel weight, and it comes with a 1GB hard disk. Moreover, its 10.4-inch TFT screen handles SVGA resolution, and its warranty covers 24-hour turnaround. Compaq is also one of only two notebook vendors (the other being Toshiba) to earn a grade of A on our latest Service and Reliability survey. If you're looking for a capable, no-frills fleet machine, the Armada should fill the bill.

THE DATA POINTS

Benchmark test scores account for approximately 30 percent of the performance/features score. Warranty policies, including length of term, availability of on-site service, and availability of technical-support lines account for about 10 percent. Display technology and maximum internal and external resolutions and refresh rates account for about 15 percent. The remaining 45 percent of the score is based on numerous features, including key size, presence of plug-and-play or flash BIOS, type of sound synthesis supported, and hard disk size.

Data is available in the hardware library of the Editorial Forum on PC MagNet under 02BANG97.txt and at our Web site (*www.pcmag.com*).

Twinhead's Slimnote 710CV lends some credence to the notion that you give up some features and performance to get a very low price. At $2,019, the Slimnote is the least expensive notebook in this roundup by almost $400. This price differential is evident in the Slimnote's features set: a Pentium/100 CPU, a dual-scan display, no CD-ROM drive, and no L2 cache. But the Slimnote was not meant to be a jaw-dropping performer: At just under 6 pounds (system weight) and just over 1 inch thick, this unit was built to be a light, thin, inexpensive notebook PC. In these respects, the Slimnote delivers.

control, and a set of audio jacks. A touch pad is integrated into the palm rest.

With its versatility, the TravelPro can satisfy a wide range of users if they're willing to pay the price.—*Cade Metz*

TravelPro 185CT. Street price: $3,300. AMS Tech, Irwindale, CA; 800-886-2671, 818-814-8851; fax, 818-814-0782; www.amstech.com. *Circle 442 on reader service card.*

ARM Computer Inc.

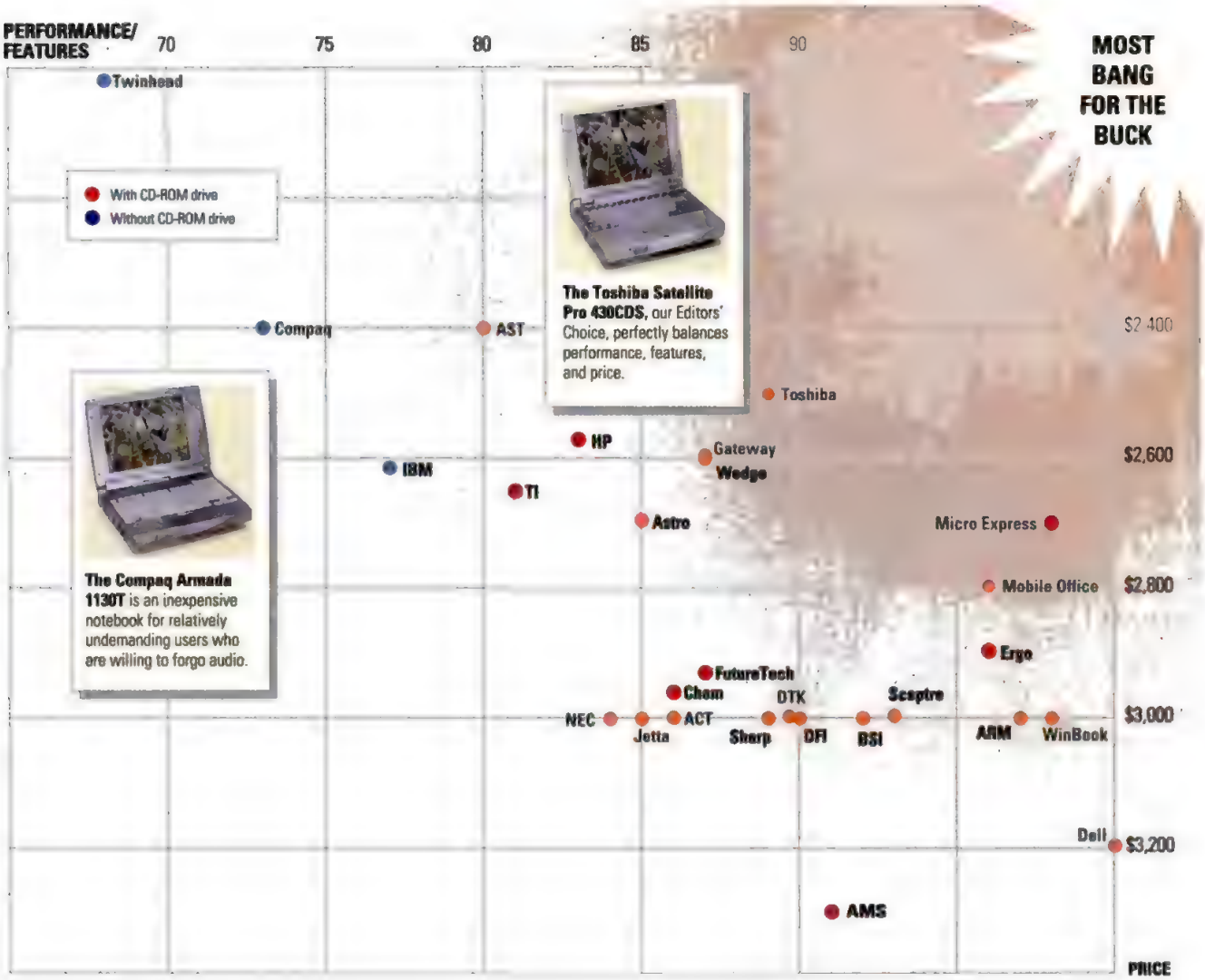
ARMNote TS96CD

This roundup's three leading performers—units from ARM, Dell, and Sceptre—are built by Full Power Investment Co., a Taiwanese manufacturer, and are fundamentally identical. The ARMNote TS96CD ($2,999 direct) showed remarkable proficiency during benchmark testing, with its 133-MHz Pentium CPU and 128-bit graphics engine. It also has a 12.1-inch active-matrix display and a long battery life.

This portable weighs 7.6 pounds (travel weight). A modular bay on the right side accommodates either a Torisan 6X CD-ROM drive, a floppy disk drive, or an optional secondary battery ($249 for lithium ion, $129 for nickel hydride). The primary hot-swappable lithium ion battery lasted for a respectable 2:53 on our BatteryMark test.

A Maxtor 1.3GB hard disk delivered the top Disk WinMark 97 score in the system's CPU class. The unit offers the usual set of I/O ports, including an 115.2-Kbps IrDA-compliant infrared port and a docking station port ($599 for a dock, $199 for a port replicator). A PC Card slot (for two Type II cards or one

SUITABILITY TO TASK	
ARMNote TS86CD	
Desktop replacement	Good
Road warrior	Good



Type III) is on the left side.

The NeoMagic graphics subsystem led to an above-average Graphics WinMark 97 score. The unit also tied for the top Winstone score within its CPU class (together with the Dell Latitude LM P-133ST), to which it was helped in part by the 256K of pipelined-burst L2 cache and Intel's Mobile Triton chip set. The only score not above average was the subpar CD-ROM WinMark 97 result.

The ARMNote is a remarkable value with a deft graphics subsystem and is backed by a decent warranty.—*CM*

ARMNote TS96CD. Direct price: $2,999. ARM Computer Inc., Milpitas, CA; 800-765-1767, 408-935-9800; fax, 408-935-9192; www.armcomputer.com. *Circle 443 on reader service card.*

AST Computer

Ascentia A41

AST Computer's Ascentia A41 is rightly targeted at SOHO and value-conscious corporate users. Priced at $2,400 (street), the Ascentia A41 posted lackluster benchmark test results. It has less-than-cutting-edge components, but its 7.8-pound travel weight led to decent tested battery life.

Samsung Electronics manufactures the Ascentia A41's motherboard, which carries a Pentium/120 CPU, a SiS chip set, and a Phoenix BIOS. The unit has no L2 cache and has standard DRAM—characteristics that conspired to produce the lowest CPUmark and Winstone scores in the P/120 class.

The notebook has another weak subsystem combination: a Cirrus Logic 7548 graphics controller with 1MB of EDO DRAM, which contributed to a below-average Graphics WinMark 97 result. The

SUITABILITY TO TASK	Ascentia A41
Desktop replacement	Good
Road warrior	Good

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Battery Life vs. Portability

As we've found in previous roundups, lithium ion–powered notebooks typically run longer than those with nickel hydride packs. Of the 27 notebooks here, 11 use lithium ion batteries.

The BatteryMark champion of this roundup is also an honorable mention here, the 8.4-pound WinBook FX, from WinBook Computer Corp. Powered by a lithium ion battery pack, the WinBook clocked an impressive time of 3:52, beating its closest competitor by nearly 1 hour. But if you think this notebook must go short on features to achieve its long battery life, you're wrong. The WinBook FX packs a powerful 133-MHz Pentium processor, a brilliant 11.3-inch active-matrix display that can handle Super VGA resolutions internally, a 6X CD-ROM drive, and a 776MB hard disk.

The WinBook FX's closest competitors on the BatteryMark test ran about an hour behind: They were AMS Tech's TravelPro 185CT (3:02) and Dell's Latitude LM P-133ST (3:00), both of which operate on lithium batteries. Like the WinBook FX, both sacrifice virtually nothing for their battery lives.

This roundup's lightest unit is the Twinhead Slimnote 710CV. It weighs in at an impressive 6.2 pounds when equipped for the road, and its svelte form is a mere 1.3 inches thick. But unfortunately, the Slimnote was not a standout performer on our BatteryMark measure, lasting only half an hour. The unit we received for testing had BIOS problems that negatively affected its battery life; Twinhead is currently working on a fix, which should be implemented by the time you read this.

In terms of design, an odd duck in this group of Pentium notebooks is the JetBook SLIM, from Jetta International. At first glance, the JetBook seems to be a capable machine: Powered by a Pentium/120 CPU and a nickel hydride battery pack, this 7.3-pound unit garnered a competitive score of nearly 2 hours on the BatteryMark test. But unlike all of the other notebooks in this

Continues

	Travel weight (pounds)	Main battery weight (pounds)	ZD Battery-Mark score (hours:minutes)	Battery life per pound of battery weight (hours:minutes)
ACT ND5123TE (Pentium/133)	9.3	1.1	1:22	1:15
AMS TravelPro 185CT (Pentium/120)	7.6	0.9	3.02	3:22
ARMNote TS96CD (Pentium/133)	7.6	1.0	2.53	2:53
AST Ascentia A41 (Pentium/120)	7.8	1.3	2:21	1:48
Astro PowerMedia III Plus (Pentium/166)	9.2	1.1	1:17	1:11
BSI NP8625A (Pentium/150)	9.3	1.3	1:35	1:13
ChemBook 9750 (Pentium/133)	8.0	1.3	1:30	1:09
Compaq Armada 1130T (Pentium/120)	7.0	1.1	2:01	1.50
Dell Latitude LM P-133ST (Pentium/133)	7.7	1.0	3.00	3:00
DFI 6620 (Pentium/133)	9.1	1.3	1:40	1:17
DTK DTN-5A120C-2M (Pentium/120)	9.4	1.3	1:45	1:21
Ergo CO-PowerBrick (Pentium/133)	8.7	1.4	1:48	1:17
FutureMate OHP (Pentium/133)	8.1	0.9	1.48	2.00
Gateway Solo 2100-120 (Pentium/120)	7.7	0.8	2:25	3:01
HP OmniBook 5500CS (Pentium/100)	8.0	0.9	2:12	2:27
IBM ThinkPad 365X (Pentium/133)	6.8	1.0	2.10	2.10
Jetta JetBook SLIM (Pentium/120)	7.3	0.9*	1:56	2:09
Micro Express NP133B (Pentium/133)	9.1	1.3	1:20	1:02
Mobile MOS8600CDT (Pentium/133)	9.1	1.3	1.00	0.46
NEC Versa 2435CD (Pentium/133)	8.6	1.4	1.57	1.24
Sceptre SoundX S4000T (Pentium/133)	7.5	1.0	2:38	2:38
Sharp PC-9030 (Pentium/120)	7.9	0.7	1:38	2:20
TI Extensa 605CD (Pentium/120)	7.4	1.1	2:18	2:05
Toshiba Satellite Pro 430CDS (Pentium/120)	7.3	0.8	2:22	2:58
Twinhead Slimnote 710CV (Pentium/100)	6.2	1.1	0:31	0:28
Wedge Showbiz-5000 (Pentium/100)	7.9	0.9	2.09	2:23
WinBook FX (Pentium/133)	8.4	1.3	3:52	2.58

* Battery weight as reported by the vendor. The battery cannot be removed and weighed separately

maximum internal resolution that the 11.5-inch dual-scan panel can display is 800-by-600 with 256 colors. You can run an external monitor at 1,024-by-768 resolution with 256 colors at a flicker-free 75-Hz vertical refresh rate.

The unit's 1GB IBM hard disk and 6X Toshiba CD-ROM drive both acquitted themselves well, yielding above-average Disk WinMark 97 and CD-ROM WinMark 97 test results. Powered by a nickel hydride battery pack, the Ascentia A41 ran for 2:21 on our BatteryMark test. The battery recharges in 2 hours when the notebook is off.

SERVICE & RELIABILITY	AST
Reliability	Worse than average
Repair	Average
Technical support	Average
Percent needing repair	Average

In addition to the E-Mail Connection, TranXit, and OAG FlightDisk software packages, the Ascentia A41 comes with CompCore MPEGsoft for playing multimedia video. Extended warranties are available beyond the standard one year.

The AST Ascentia A41 is a good match for relatively undemanding applications for which decent battery life matters more than blistering speed.—*BB*

Ascentia A41. Street price: $2,400. AST Computer, Irvine, CA; 800-876-4278; fax, 714-727-9355; www.ast.com. *Circle 444 on reader service card.*

Astro Research Inc.

PowerMedia III Plus

Astro Research's PowerMedia III Plus ($2,695 direct) is marketed for government and insurance-company users who want a notebook with a fast CPU. The PowerMedia III Plus boasts the fastest CPU in this roundup, a Pentium/166, but its limited battery life and surprisingly low test scores outweigh the benefits of this feature.

The 9.2-pound (travel weight) Power-

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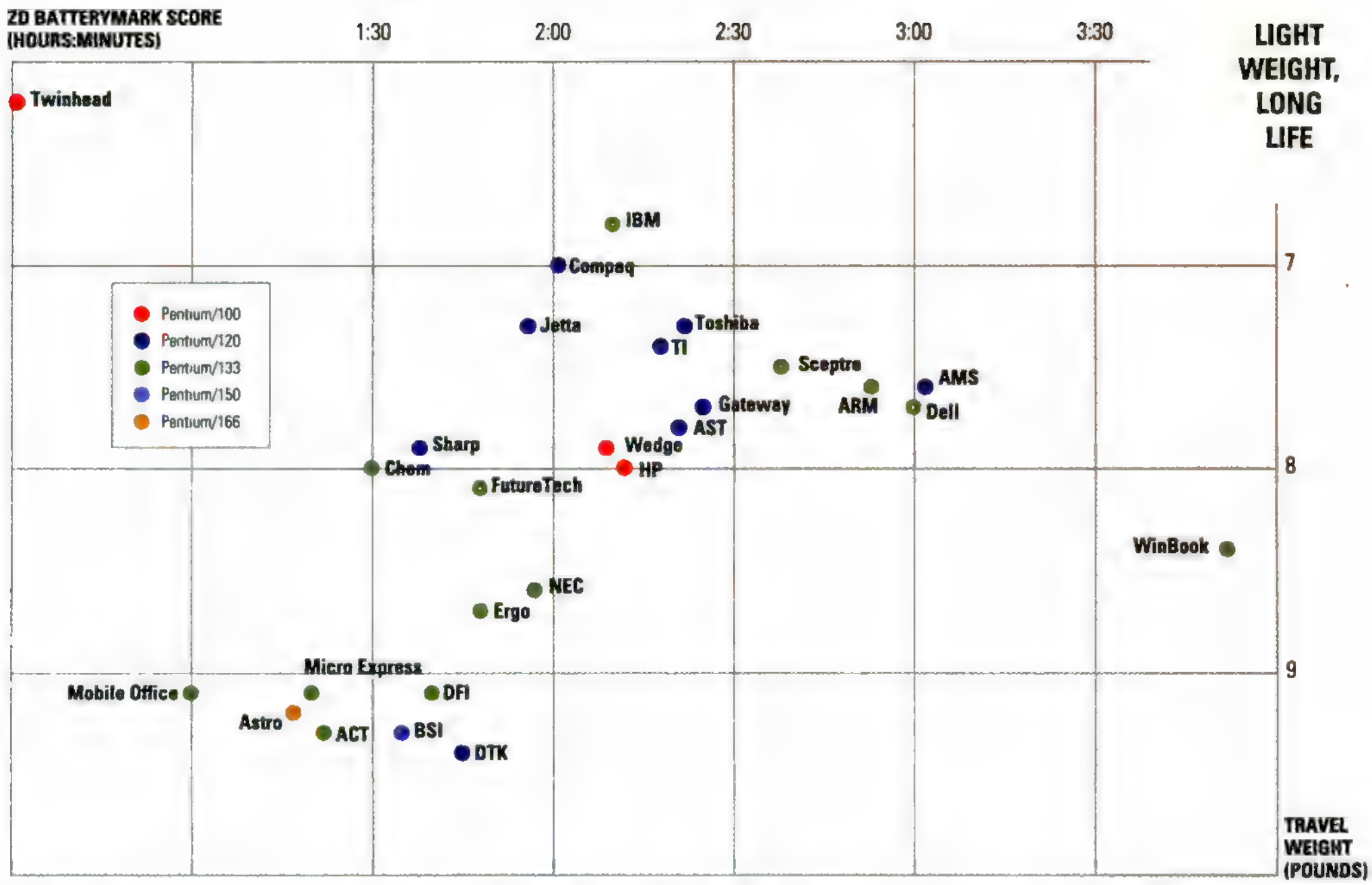

Continued
roundup, which have easily removable batteries, the JetBook SLIM makes removing the battery difficult. According to Jetta, the only way for you to do so is to take off the palm rest, remove two screws, and pry the battery out of the case. If you require more than 2 hours of battery life (on a coast-to-coast flight, for example), we don't think the JetBook is the notebook for you. In the time it takes to remove the palm rest, unscrew and remove the battery, and put in a new one, you will likely lose any unsaved data.

Our figure for the JetBook's battery life per pound of battery weight is based on the battery weight that Jetta supplied to us, because the unit we received did not enable us to remove the battery without the risk of damaging the motherboard. (Other weights reported here were measured by PC Labs.)

Note that each travel weight reported here includes the notebook with its primary battery installed, plus the weight of the AC adapter and the power cord. We include the weight of the CD-ROM drive if one comes with the unit, but we exclude the weight of the floppy disk drive, because most notebook users probably travel with only one of those components.

Media III Plus offers a SiS chip set, an AMI BIOS, 256K of pipelined-burst L2 cache, and EDO DRAM. But its CPU score was low, on a par with that of 120-MHz systems instead of being what we expected from a 166-MHz unit. Its other test scores were also low, falling below the averages of this roundup's 133-MHz units.

You won't get much time on battery power with this system, either: With its nickel hydride battery, it lasted only 1:17 on our BatteryMark test. The system's one highlight was a CD-ROM WinMark 97 score that was above the average of this roundup's 133-MHz and 150-MHz units.

Astro's PowerMedia III Plus came equipped with a 1GB Toshiba hard disk and a 12.1-inch active-matrix display. Its graphics are managed by a C&T 65550 chip set with 2MB of DRAM, capable internally of Super VGA resolution with 16.7 million colors. The system also includes the software package Xing MPEG Player 3.0.

SUITABILITY TO TASK

PowerMedia III Plus	
Desktop replacement	Good
Road warrior	Fair

Astro's PowerMedia III Plus notebook looks good on paper, but its disappointing performance tells a different story.—*BB*

PowerMedia III Plus. Direct price: $2,695. Astro Research Inc., Monterey Park, CA; 800-367-6683, 818-293-1651; fax, 818-293-1655; www.astronote.com. *Circle 445 on reader service card.*

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The Great Subnotebook Road Test

By Carol Venezia

Buying a notebook PC is a lot like buying a car: You never really know how it's going to handle until you get it home and drive it yourself. This is especially true of subnotebooks, or "ultraportables," as the vendors like to call them. Vendors load them up with lithium batteries and promise long life, but once again, the car analogy kicks in: "Actual mileage may vary."

As a supplement to this value notebook story, we decided to round up the most popular subnotebooks, put them into the hands of *PC Magazine* editors and project leaders, and see how they handled in real-world situations (note that the battery times quoted are not from our BatteryMark test). Below, we examine the Digital HiNote Ultra II, the HP OmniBook 800CT, the IBM ThinkPad 560, and the Toshiba Portégé 650CT. And although it's technically not a subnotebook, we also look at the Compaq Armada 4130T.

DIGITAL HINOTE ULTRA II

Digital's $4,799 (street price) HiNote Ultra II may come in one of the smallest packages here, but it packs a big punch—a 150-MHz Pentium CPU and a 1.44GB hard disk, all in a 4.8-pound package (add about seven-tenths of a pound for the floppy disk drive). The HiNote's footprint is also compact, but inside you'll find an 11.3-inch active-matrix SVGA display and a near-full-size keyboard. Unlike other subnote keyboards, which are smallish and difficult to type on, the HiNote provides a good deal of key travel.

Power management settings for the HiNote are BIOS-based and are easy to set if you don't mind klunking around in DOS. For the faint of heart, there's a maximum battery life auto-switch. For the more adventurous, you'll find hard disk, standby, and suspend timers; PC Card socket power suspend; and options to turn off all ports. The HiNote's suspend/resume feature works very well: Even after days in suspend mode, the system came back up within a few seconds. With the BIOS tuned to maximum battery life and the display brightness turned down, the HiNote's 3,300-mAh lithium ion battery performed quite well, averaging about 3 hours of life under heavy workloads (loading software and frequently saving large files to disk).

HP OMNIBOOK 800CT

The good news about the $4,370 (street price) HP OmniBook is that it's small: At just 4.6 pounds with AC adapter (add seven-tenths of a pound for the floppy disk drive) and a compact 11- by 7-inch footprint, you'll hardly know you're carrying it. More good news: This small case fits a 10.4-inch active-matrix SVGA display, a Pentium/133 CPU, and a 1.3GB hard disk inside. It also has easy-to-set (although limited) power management features, including system and hard disk timeout settings and IRQ auto-turnoffs.

Now the bad news. The OmniBook's display is too small for its factory-set resolution of 800-by-600. We suggest changing the resolution or increasing the font size; otherwise you won't be able to see what you're typing. The keyboard is also deceptive: It's surprisingly full-size, but the keys are stiff and difficult to type on.

One of the unique features of the OmniBook is its miniature mouse, which pops out of the right side of the notebook and is tethered by a short arm resembling a Popsicle stick. It works great on a desk but is very difficult to use on a tray table or on your lap. Another unique feature of this notebook is its on/off switch, which controls the unit's instant-on feature. Although this is a great concept—allowing you to return to your work session without having to reboot—it was unreliable. About half the time, our road tester found himself

Continues

Broadax Systems Inc.

BSI NP8625A

The $2,999 (direct) BSI NP8625A is best described as a desktop/notebook hybrid. The unit is heavy and has a short battery life, but its feature set rivals that of many stationary PCs. The only system in this roundup to couple a Pentium/150 (the 3.1-volt desktop chip) with a 12.1-inch active-matrix display, it provides average performance and 64-bit Super VGA graphics.

At a travel weight of 9.3 pounds, the NP8625A is one of the heaviest systems reviewed here, partly because both the floppy disk drive and the 6X Toshiba CD-ROM drive are integrated. Typing is made easy with the full-size keys, the touch pad, and two plastic feet that can set the notebook on an incline.

The unit's underside houses the nickel hydride Duracell smart battery (which lasted only 1:35 on our BatteryMark test) and the system's

SUITABILITY TO TASK	BSI NP8625A
Desktop replacement	Good
Road warrior	Good

ILLUSTRATION BY AARON ROTH

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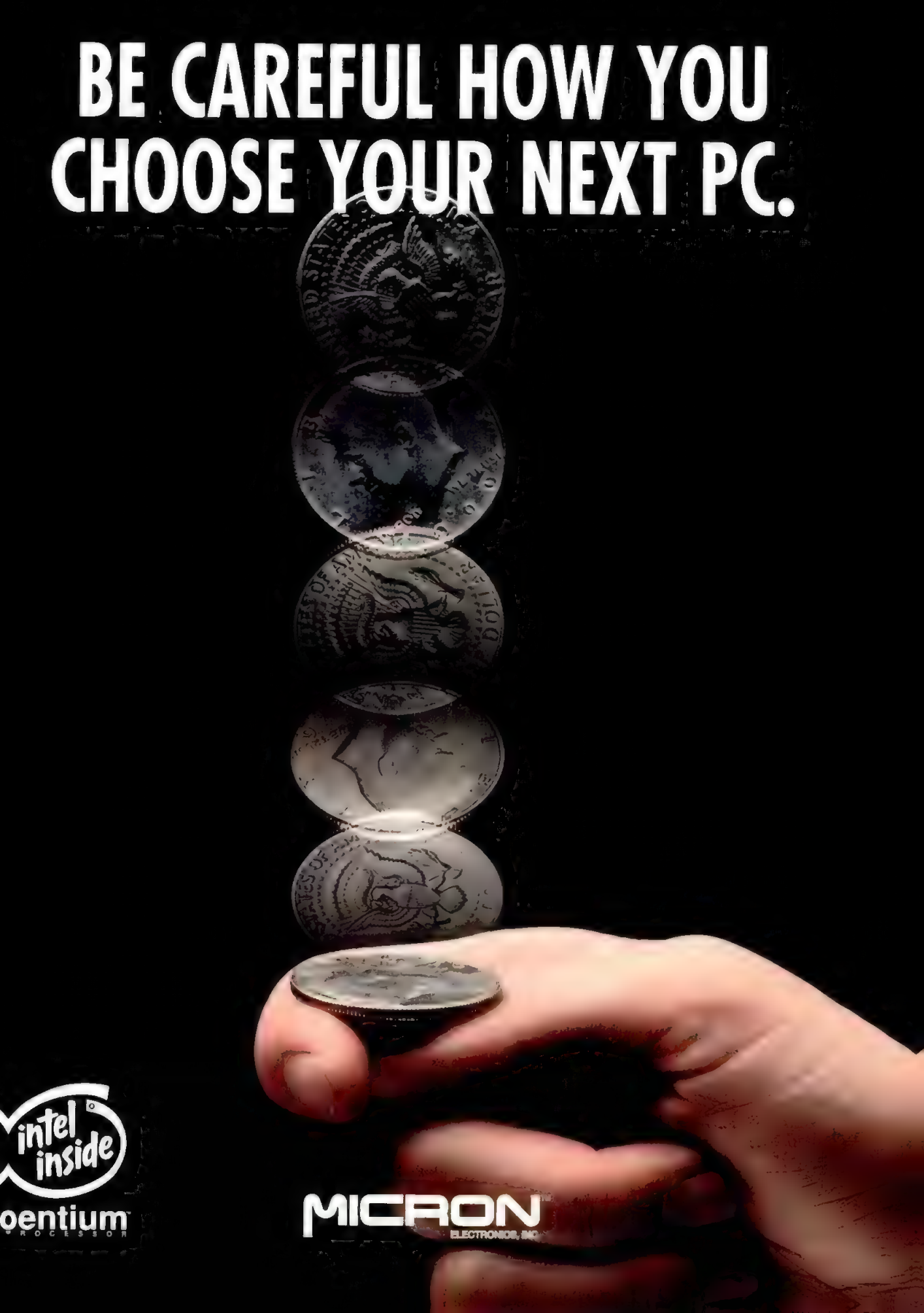

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Continued
reaching for a pen to hit the reset switch. The OmniBook's battery life averaged about 90 minutes, not surprising given the battery's 2,700-mAh capacity.

IBM THINKPAD 560
If you put the $4,199 (street) IBM ThinkPad 560—recipient of our 1996 Award for Technical Excellence—on a desk and looked down at it, you'd never know it was a subnote: Its footprint is actually slightly larger than a full-size notebook. But look at it from the side and you'll see why it weighs only 4.8 pounds (add seven-tenths for the floppy disk drive): It's barely an inch thick.

Inside the ThinkPad's svelte package you'll find a gorgeous 12.1-inch SVGA display, a full-size keyboard, a Pentium/133 CPU, and a 1GB hard disk. The system's power management features are highly flexible and easy to configure. The ThinkPad Features utility is a graphical program that allows you to enable or disable many features, including hard disk, display, all ports, audio, and PC Card slots. You can either choose your own settings or let the ThinkPad do the work for you in high-performance or automatic mode.

Battery life for the ThinkPad averages about 2.5 hours from its 2,200-mAh lithium ion pack if you're aggressive with its power management settings. The system's suspend/resume feature is highly reliable; it can also hibernate effectively for days.

TOSHIBA PORTÉGÉ 650CT
A perennial favorite in this class is Toshiba's $4,499 (street) Portégé 650CT, which has an 11.3-inch SVGA display, a Pentium/133 CPU, and a 1.3GB hard disk. One of its best features is a built-in 28.8-Kbps modem. Toshiba has also enlarged the keyboard and used a crisscross spring design to make it responsive.

As the Portégé gained features, it grew heavier (to 5.9 pounds, plus half a pound for the floppy disk drive) and lost battery life. Where previous-generation Portégés have been known to last 4 to 5 hours on their lithium ion battery packs, our road testers were getting only 2 hours of life with the 650CT. Part of the reason for this (besides the faster CPU and larger display) is that the 650's battery capacity is lower than that of the previous-generation 650s: 3,400 mAh versus the 610's 4,000-mAh rating.

Our road testers had mixed reactions to the Portégé's power-down and auto-resume features. One was pleased with the performance of these features, while the other found the resume to be agonizingly slow—anywhere from 40 seconds to over a minute; the screen also blanked two or three times during this process. We also found the Portégé's Access Panel to be cranky: It caused the machine to crash at times and sometimes wouldn't hide in the background. But overall, the Portégé is still a worthy road warrior.

COMPAQ ARMADA 4130T
Compaq's $4,599 (street price) Armada 4130T is classified by the vendor as a "hybrid" machine: It's a versatile, lightweight notebook by itself or a multimedia system if you add the Mobile CD Expansion Unit to its base.

Considered as a notebook by itself, the Armada is impressive in most respects. With a Pentium/133 CPU, a 1.4GB hard disk, and an 11.8-inch active-matrix SVGA screen, the 6.1-pound Armada is ready to take on demanding tasks (travel weight includes the optional secondary battery; add 8 ounces for the floppy disk drive). The only chink in this PC's armor is its battery: The primary battery for this unit clips onto the back of the notebook and swings up to act as a carrying handle. With this battery attached, the Armada will not fit into a standard-size notebook computer bag.

The Armada's battery life was impressive. With its secondary lithium ion pack installed (a $199 option), our road tester got an average of about 2.5 hours of life—and this was while performing such computing-intensive functions as Visual Basic compiles.

Stationary computing with the Armada is enhanced by the Mobile CD Expansion Unit. This unit, which easily clips onto the bottom of the Armada, adds about three-quarters of an inch of height and about 3 pounds to the notebook's weight. Our test unit featured a 4X CD-ROM drive (8X is now standard), speakers, and a MIDI port. Overall, the Armada is a great computing solution if your needs don't call for full-time multimedia capabilities.

2.1GB Toshiba hard disk. In the rear of the machine, two doors cover I/O ports, an 115.2-Kbps infrared port, and a docking station port. The notebook has a PC Card slot that can accept one Type III or two Type II cards. An NTSC video-out port is also integrated.

The NP8625A comes with a 64-bit Trident graphics chip set that has 2MB of EDO DRAM. Its internal makeup also includes 256K of synchronous L2 cache and 16MB of EDO memory. All of its test scores were average except for the CD-ROM WinMark score, which was above average.

The NP8625A targets corporate users who prefer performance over portability. Although a bit unwieldy, it is one of the few systems in this roundup to integrate both a floppy disk drive and a CD-ROM drive.—*CM*

BSI NP8625A. Direct price: $2,999. Broadax Systems Inc., El Monte, CA; 800-872-4547, 818-442-0020; fax, 818-442-4527; www.bsicomputer.com. *Circle 446 on reader service card.*

Chem USA Corp.

ChemBook 9750

Chem USA's $2,960 (street) ChemBook 9750 is targeted specifically at SOHO users and at business travelers who need a fast multimedia system. Built by Chicony Electronics of Taiwan, the Pentium/133-based ChemBook—which has a 12.1-inch active-matrix display, a 1.3GB Toshiba hard disk, and a 6X TEAC CD-ROM drive—registered average to above-average performance on our

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BENCHMARK TESTS

Value Notebooks

They may carry low price tags, but these value notebooks won't shortchange you in terms of features. With muscular Pentium processors, pipelined-burst secondary cache, and fast graphics engines, this crop of 27 machines aims to please.

What the Numbers Mean

ZD Business Winstone 97 Highly optimized notebooks packing powerful CPUs, pipelined-burst L2 cache, EDO main memory, and fast graphics accelerators posted top scores on our Winstone 97 benchmark tests. The best performers on this measure were ARM Computer's ARMNote TS96CD and Dell's Latitude LM P-133ST (tied for first place), followed closely by Sceptre Technologies' SoundX S4000T. These notebooks are functionally the same machine (only a few components differ), manufactured by Full Power Investment Co. of Taiwan.

At the other end of the Winstone scale were a group of systems that suffered performance penalties on all measures due to their lack of L2 cache: the Twinhead Slimnote 710CV (a Pentium/100), the AST Ascentia A41, the TI Extensa 605CD, and the Compaq Armada 1130T (Pentium/120s); also the IBM ThinkPad 365X and the NEC Versa 2435CD (Pentium/133s). In fact, the ThinkPad's Winstone score was below average compared with the Pentium/120 group—which goes to show that a powerful processor alone does not guarantee top performance if it isn't integrated with L2 cache and a fast memory subsystem.

AMS Tech's TravelPro 185CT is a great example of what optimized subsystems will buy you. This Pentium/120 notebook posted a Winstone score that was on a par with the average yielded by the Pentium/133s. A combination of a 4,464-rpm Hitachi DK213A hard disk and a NeoMagic MagicGraph128 graphics engine, complemented by Intel's 430MX chip set and 256K of pipelined-burst L2 cache, gave the AMS system a most desirable performance boost (and the best Winstone score in its Pentium/120 class).

ZD Business Graphics WinMark 97 In this roundup we saw two different 64-bit graphics chip sets (Chips & Technologies' 65550 and Trident's Cyber 9385), as well as one 128-bit accelerator (NeoMagic's MagicGraph128). The NeoMagic accelerator—found in the ARMNote, the AMS TravelPro, the Dell Latitude, and the Sceptre SoundX—is a single-chip solution, which integrates a 128-bit graphics engine, an 18-bit 3.3V RAMDAC, and 1MB of DRAM memory, coupled with a 128-bit memory path. The four NeoMagic-equipped notebooks produced the top Graphics WinMark scores: Their scores were, on the average, 20 percent higher than the next-closest competitors.

Once again, we find the cacheless notebooks at the bottom of the performance scale. The Versa 2435CD and the ThinkPad 365X—even though they both use 133-MHz CPUs—posted Graphics

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.
Bold type denotes first place within each category.

	ZD Business Winstone 97 (Score)	ZD Business Graphics WinMark 97 (Score)	ZD Business Disk WinMark 97 (Thousands of bytes per second)	ZD CPUmark32 (Score)
PENTIUM/166				
Astro PowerMedia III Plus	20	28.6	301	203
PENTIUM/150				
BSI NP8625A	24	35.5	377	231
PENTIUM/133				
ACT ND5123TE	23	33.7	344	236
ARMnote TS96CD	**28**	43.4	**434**	261
ChemBook 9750	24	34.0	402	228
Dell Latitude LM P-133ST	**28**	43.8	417	258
DFI 6620	22	35.6	331	233
Ergo CD-PowerBrick	19	22.4	354	181
FutureMate OHP	21	27.3	410	192
IBM ThinkPad 365X	18	19.3	372	165
Micro Express NP133B	25	35.2	423	232
Mobile Office MOS8600CDT	24	35.0	352	236
NEC Versa 2435CD	19	16.8	357	175
Sceptre SoundX S4000T	27	**44.3**	363	**263**
WinBook FX	23	31.7	340	242
	BETTER ▶	BETTER ▶	BETTER ▶	BETTER ▶

* With an Action, Indeo, 320-by-240, 30-fps, 600-KBps clip
N/A—Not applicable This notebook does not have a CD-ROM drive

WinMark scores that fell below the *Pentium/100* group's average. Add to these notebooks' trailing-edge 32-bit graphics engines the effect of no L2 cache and you get comparatively poor performance. These scores are more interesting given that a fair amount of our Graphics WinMark tests is influenced by CPU speed.

ZD Business Disk WinMark 97 As with desktop PCs, hard disk rotational speed makes a big difference in Disk WinMark scores. Three of the top four Business Disk WinMark 97 performers—the ARMNote, the Micro Express NP133B, and the FutureTech FutureMate OHP all used 1.3GB Maxtor 251350AT hard disks with a spindle speed of 4,464 rpm. The Dell Latitude, equipped with a 1.3GB, 4,000-rpm IBM DMCA-21440 hard disk, was also a contender on this test. Unlike typical desktop IDE disks that spin at rates of 4,800 to 5,400 rpm, in the notebook arena we currently find 4,000- to 4,900-rpm devices (mainly because notebooks demand smaller, lower-power devices than desktops).

ZD CPUmark$_{32}$ Processors used in notebooks in this roundup varied from Pentium/100 at the low end (found in 3 units) to Pentium/120 (9 units), Pentium/133 (13 units), Pentium/150 (1 unit), and even one Pentium/166. Intel currently doesn't sell a "mobile" Pentium/166 processor with VRT (Voltage Reduction Technology), but that doesn't mean that vendors can't use a standard-voltage chip in a desktop-style ceramic package (as opposed to Intel's tape-carrier packaging, which uses less motherboard real estate). However, VRT allows the Pentium CPU to run at 2.9 volts internally (for most mobile Pentiums; note that the mobile Pentium/150 runs at 3.1 volts internally) while interfacing with outside components at 3.3 volts. This scheme conserves power and, in an ideal scenario, increases battery life compared with a non-VRT chip.

The top performers on our CPUmark$_{32}$ tests were once again the Sceptre SoundX, the ARMNote, and the Dell Latitude. All of these notebooks benefited from the use of fast pipelined-burst or synchronous L2 cache (instead of the slower asynchronous variety), Intel's mobile Triton chip set, and EDO DRAM. The top-performing Pentium/120s—the Gateway Solo 2100-120 and the AMS TravelPro 185CT—used the same core components and outscored the average Pentium/120 by an impressive 21 percent on our CPUmark tests.

The CPUmark underachiever in this roundup was Astro Research's PowerMedia III Plus. We expected it to perform well, given its components: a Pentium/166 CPU, 256K of pipelined-burst L2 cache, a SiS 5101 chip set, and EDO DRAM. However, its CPUmark$_{32}$ score of 203 put it on a par with many of the Pentium/120 systems. We attribute this performance to the system's write-through cache policy setting in its BIOS. We attempted to set the cache policy to write-back to gauge the expected performance gain, but the system proceeded to stall on boot-up. This system may carry a speedy CPU, but it is poorly optimized.

ZD BatteryMark Many of the notebooks here benefited from Intel's VRT-enhanced, TCP-packaged CPUs. These processors reduce system power—and therefore battery drain—compared with machines still using ceramic-packaged, non-VRT CPUs. Eleven of the 27 units reviewed had lithium ion batteries, which generally give more life than nickel hydride. Our top BatteryMark performer was the lithium-equipped WinBook FX: It clocked an impressive 3:52, nearly 1 hour more than its closest competitor.

ZD BatteryMark	ZD CD-ROM WinMark 97	CD-ROM			Medium-Quality Action Indeo*	
Hours:minutes	Thousands of bytes per second	Sequential 16K Read (KBps) ▲	Access Time (ms) ▼	CPU Utilization (percent) ▼	Frames Dropped ▼	CPU Utilization (percent) ▼
1:17	581	917	233	74	69	98
1:35	618	912	200	46	12	97
1:22	583	918	225	72	9	96
2:53	417	896	302	43	44	92
1:30	562	917	237	42	0	97
3:00	448	923	268	43	10	95
1:40	617	905	182	63	10	96
1:48	522	916	271	44	14	97
1:48	539	919	244	41	6	97
2:10	N/A	N/A	N/A	N/A	N/A	N/A
1:20	629	905	179	62	9	97
1:00	618	907	187	61	9	96
1:57	468	900	268	44	23	98
2:38	405	915	268	43	0	97
3:52	557	918	253	42	4	96
BETTER ▶	BETTER ▶					

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BENCHMARK TESTS

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.

Bold type denotes first place within each category.

	ZD Business Winstone 97 (Score)	ZD Business Graphics WinMark 97 (Score)	ZD Business Disk WinMark 97 (Thousands of bytes per second)	ZD CPUmark32 (Score)
PENTIUM/120				
AMS TravelPro 185CT	**24**	**41.3**	304	243
AST Ascentia A41	17	17.1	370	170
Compaq Armada 1130T	19	22.2	311	186
DTK DTN-5A120C-2M	22	33.3	345	216
Gateway Solo 2100-120	23	27.0	**405**	**246**
Jetta JetBook SLIM	21	27.8	358	201
Sharp PC-9030	19	26.9	327	201
TI Extensa 605CD	18	20.4	328	172
Toshiba Satellite Pro 430CDS	20	23.5	356	183
PENTIUM/100				
HP OmniBook 5500CS	**21**	**25.4**	**402**	**201**
Twinhead Slimnote 710CV	16	15.6	313	180
Wedge Showbiz-5000	19	25.3	328	169
	BETTER ▶	BETTER ▶	BETTER ▶	BETTER ▶

* With an Action, Indeo, 320-by-240, 30-fps, 600-KBps clip
N/A—Not applicable This notebook does not have a CD-ROM drive

At the other end of the BatteryMark scale was the Twinhead Slimnote 710CV, which lasted for only half an hour. After several retests and consultations with Twinhead engineers, we determined that the system had a BIOS-related problem. Twinhead confirmed that a fix was underway but that it would not be ready in time for our technicians to retest the machine. By the time you read this, however, the corrective fix should be implemented.

ZD CD-ROM WinMark 97 and multimedia tests Unlike the situation just a short time ago, CD-ROM drives are becoming standard equipment in notebooks of all types. In this roundup of 27 notebooks, 24 have the hardware necessary to spin your favorite CD. The vast majority (22 units) use 6X drives; we saw one 4X mechanism and even a 10X drive in the Toshiba Satellite Pro.

All the CD-ROM drives performed within if not a bit above their transfer rates except for the Toshiba XM-1502B 10X drive. On our CD-ROM Sequential 16K Read test, this drive posted a score (transfer rate) of 1,150 KBps, which is a bit lower than an 8X transfer rate. We believe that drive we tested is an early release of the product and as yet is not fully optimized.—*Analysis written by Charlie Rodriguez*

How We Tested

We tested all notebooks with 810MB hard disks or larger and 16MB of RAM. We used each vendor's preinstalled graphics driver for the screen's maximum internal resolution with 64,000 colors, small fonts, and a refresh rate of 75 Hz. We also disabled power management features and removed unnecessary drivers.

We used our benchmark test program ZD Winstone 97, Version 1.0, to measure the notebooks' performance when running 32-bit Windows 95 applications. Winstone 97 is divided into two categories: *ZD Business Winstone 97*, focusing on mainstream applications, and *ZD High-End Winstone 97*, which emphasizes CPU- and graphics-intensive applications. In this roundup, we ran only the **ZD Business Winstone** tests, which measure the time a PC takes to execute a set of application scripts that exercise eight of the best-selling Windows 95 applications. Business Winstone weights a given PC's test timings based on the applications' unit market shares; it derives a composite number and converts it to a relative score. (The score is relative to the performance of a Gateway 486DX2/66 with 16MB of RAM, whose score is defined as 10.)

ZD WinBench 97, Version 1.0, measures graphics, disk, processor, CD-ROM, and motion-video performance under Windows 95.

benchmark tests, except for its relatively short battery life.

The 6.8-pound (travel weight) ChemBook uses a Chicony motherboard with an OPTi Viper chip set, 256K of synchronous L2 cache, and standard DRAM. On our benchmark tests, the ChemBook was a competitive performer in its 133-MHz Pentium class: It posted an above-average CD-ROM score and garnered average results on the Disk WinMark, Winstone, Graphics WinMark, and CPUmark tests.

A Chips & Technologies 65550 graphics accelerator with 2MB of EDO DRAM handles up to 16.8 million colors at 800-by-600 resolution on the internal display. The system can run at a 75-Hz vertical refresh rate on an external monitor, at both 800-by-600 and 1,024-by-768 resolutions. The notebook also boasts a full-size NTSC video-out port and one Type III PC Card slot, which will also accept two Type II devices, as well as built-in FM-synthesis audio with the usual complement of jacks.

SUITABILITY TO TASK

ChemBook 9750

Desktop replacement	Good
Road warrior	Good

ZD BatteryMark Hours:minutes	ZD CD-ROM WinMark 97 Thousands of bytes per second	CD-ROM Sequential 16K Read (KBps) ▲	CD-ROM Access Time (ms) ▼	CD-ROM CPU Utilization (percent) ▼	Medium-Quality Action Indeo* Frames Dropped ▼	Medium-Quality Action Indeo* CPU Utilization (percent) ▼
3:02	552	910	227	46	6	96
2:21	595	907	200	62	293	97
2:01	N/A	N/A	N/A	N/A	N/A	N/A
1:45	615	910	194	47	11	97
2:25	555	917	246	46	3	93
1:56	586	918	237	44	12	96
1:38	472	910	202	61	363	98
2:18	537	908	224	62	13	97
2:22	789	1,150	156	54	11	97
2:12	449	613	230	37	14	96
0:31	N/A	N/A	N/A	N/A	N/A	N/A
2:09	549	920	248	23	4	96
BETTER ▶	BETTER ▶					

Like our Winstone test program, ZD Graphics WinMark 97 and ZD Disk WinMark 97 are each divided into Business and High-End sections. In this roundup, we ran only the Business portions.

The **ZD Business Graphics WinMark 97** score, a number based on a log of GDI operations used in Business Winstone 97, represents the performance of each machine's graphics subsystem under Windows 95. Scores are normalized to reflect performance relative to the Business Winstone base system. The **ZD Business Disk WinMark 97** score, based on a log of disk functions used in the Business Winstone program, represents the performance of each machine's disk subsystem under Windows 95. Results are reported in thousands of bytes per second. The **ZD CPUmark$_{32}$** score reflects the speed of a PC's processor subsystem under 32-bit operating systems.

Our **ZD BatteryMark** test measures a notebook's battery life by exercising three different 32-bit software workload engines, one each for CPU, disk, and graphics tasks. BatteryMark mixes these workloads together and adds periodic *think times*, or breaks, in the work that reflect the way users pause while working; however, the rest doesn't allow notebooks to enter standby mode. We use standard power management settings during testing: 30 seconds for display timeout, 2 minutes for hard disk timeout (or the closest value available), and Auto or Fast CPU speed.

On notebooks that had a CD-ROM drive, we ran our **ZD CD-ROM WinMark 97** tests. These tests are based on a profile of six of today's most popular Windows CD-ROMs. We report the results of the **CD-ROM Sequential 16K Read** test, which measures the throughput of a CD-ROM subsystem as it reads 16K blocks of data on a CD-ROM. The **CD-ROM Access Time** test measures CD-ROM drive performance as it randomly accesses and reads 2K blocks from the entire CD-ROM. The **CD-ROM CPU Utilization** figure represents the percentage of the CPU's bandwidth occupied by servicing the CD-ROM subsystem as it retrieves data. To determine the amount of utilization, WinBench 97 uses a default block size of 16K. The transfer rate defaults to the maximum rate of your particular CD-ROM subsystem. WinBench 97 calculates this transfer rate before running the actual test.

WinBench 97 also includes a suite of video clips that measure a PC's ability to play full-motion .AVI files. We report results from the **Medium-Quality Action Indeo** test, which uses an Indeo, 320-by-240, 30-frame-per-second, 600-KBps video clip. For this test, we report Frames Dropped and CPU Utilization.

On the downside, the system's nickel hydride battery, which recharges in 2 hours 30 minutes with the power off, lasted only 1:30 on our BatteryMark test.

If you don't need to have bleeding-edge performance or long battery life, the ChemBook 9750 is a decent choice as an all-purpose notebook.—*BB*

ChemBook 9750. Street price: $2,960. Chem USA Corp., Hayward, CA; 800-866-2436, 510-785-8080; fax, 510-785-1010; www.chemusa.com. *Circle 447 on reader service card.*

Compaq Computer Corp.

Compaq Armada 1130T

Compaq Computer Corp.'s $2,400 (street) Compaq Armada 1130T is targeted at small-business owners, MIS departments, and other consumers looking for a basic notebook at a reasonable price. This 120-MHz Pentium portable with a 10.4-inch active-matrix screen fills the bill. The system has a sturdy case and weighs only 7 pounds (travel weight); on the downside, the Armada lacks sound and also has no secondary cache, a characteristic that affected its performance.

Features provided by most of the other notebooks in this roundup are absent here. Not only does the Armada lack audio and an internal CD-ROM drive, but it's the only reviewed notebook with no infrared port. It is, however, one of the smaller of the systems we examined, making it easy to carry.

Compaq's own motherboard and an OPTi chip set form the core of the unit.

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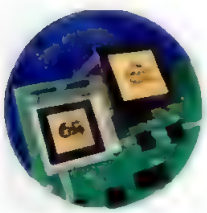

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- 15" Princeton Graphics *EO* .28dp NI (13.8"VA) Color Monitor
- 104-Key keyboard, Microsoft® Mouse
- Microsoft Windows®95 w/ Microsoft Plus!
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SUMMARY OF FEATURES

Value Notebooks

Price of tested configuration For units sold through resellers, assume that street prices are 15 to 20 percent lower than list prices. Some vendors factor this discount into their quoted prices; in such cases, we indicate that the cited price is a street price. Companies that sell directly to consumers have direct prices, with no expected discounting.

System weight/Travel weight The system weight includes the weight of the battery. The travel weight adds the weight of the AC adapter, the power cord, and the CD-ROM drive, but not the weight of a floppy disk drive that is external or that can be swapped for the CD-ROM drive.

Virtual desktop When you use a notebook's LCD panel and an external monitor simultaneously, virtual desktop enables a higher resolution on the monitor than the LCD panel can normally produce.

Installed/maximum hard disk capacity We report the capacity in megabytes (units of 1,048,576 bytes). Some manufacturers quote millions of bytes (which makes capacity appear about 5 percent larger).

NTSC video in/out These ports meet specifications set by the National Television Standards Committee and allow you to input directly from or output directly to a television set.

Battery hot-swapping/Smart battery Systems with battery hot-swapping capability let you change batteries without shutting down or losing data. A smart battery has intelligent electrical circuitry that more accurately measures remaining battery capacity and provides this information to the system.

Dead pixel policy Vendors vary in the number and position of dead (burned-out) screen pixels they require before they will replace your notebook—for example, 1 dead pixel or 15 within a certain area. All the notebooks in this roundup are capable of simultaneous external display, and all have serial, parallel, and VGA ports.

While it uses speedy EDO DRAM, the lack of an L2 cache no doubt held back overall performance. On all measures except our Graphics WinMark test, where it earned a below-average score, the Armada's test scores were barely average for its CPU class. The nickel hydride battery's life tested at 2:01—not bad for the group but low when you consider that it has fewer devices to run.

SERVICE & RELIABILITY

Compaq

Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Better than average

You won't buy the Armada for its performance or for multimedia presentations. But if you want a fairly small and inexpensive unit from a reliable company for nondemanding portable applications, the Compaq Armada 1130T is worth a look.—*BB*

Compaq Armada 1130T. Street price: $2,400. Compaq Computer Corp., Houston; 800-345-1518; fax, 713-518-1442; www.compaq.com. *Circle 448 on reader service card.*

SUITABILITY TO TASK

Compaq Armada 1130T

Desktop replacement	Fair
Road warrior	Good

Dell Computer Corp.

Latitude LM P-133ST

Dell Computer's $3,199 (direct) Pentium/133-powered Latitude LM P-133ST differs from the ARMNote TS96CD and the Sceptre SoundX S4000T only in hard disk, software bundle, BIOS, and some cosmetic alterations. (Both of the other units are also manufactured by Full Power Investment and are included in this story.) The Latitude was a top performer in this roundup, posting above-average scores on nearly every test program, including the number-one Winstone 97 score.

The Latitude is the most aesthetically pleasing machine in the Full Power Investment trio. It has a sleek ebony chassis that houses a bright 12.1-inch active-matrix display. With a 7.7-pound travel weight, it is an ounce or two heavier than the ARMNote TS96CD and the Sceptre SoundX S4000T, but it has identical dimensions.

The Latitude tied with the ARMNote for the top Winstone score in their class. It also posted an above-average Disk WinMark 97 score thanks to a 1.3GB IBM hard disk. The Graphics WinMark 97 and CPUmark scores were also above average.

The unit's BIOS uses a different power management scheme than other notebooks, and it allows you to select the CD-ROM drive's speed (either 4X or 6X). The 6X Torisan CD-ROM drive helped the unit score within the average range for the CD-ROM WinMark test. On our BatteryMark test, the Latitude's lithium ion pack lasted an impressive 3 hours before running out of power.

With this unit, Dell bundles its Mobile Solutions software bundle, which features an MPEG package from Xing, Sidekick 95, and LapLink for Windows.

SERVICE & RELIABILITY

Dell

Reliability	Better than average
Repair	Average
Technical support	Average
Percent needing repair	Average

The Latitude is an attractive notebook with great battery life, a strong warranty, and round-the-clock live technical support.—*CM*

Latitude LM P-133ST. Direct price: $3,199. Dell Computer Corp., Austin, TX; 800-388-8542, 512-338-4400; fax, 512-728-3653; www.dell.com. *Circle 449 on reader service card.*

SUITABILITY TO TASK

Latitude LM P-133ST

Desktop replacement	Good
Road warrior	Excellent

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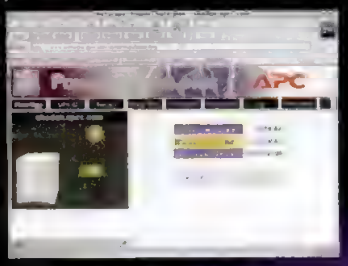

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SUMMARY OF FEATURES

Value Notebooks

■ YES ■ NO
In alphabetical order by company

	ACT ND5123TE	AMS TravelPro 185CT	ARMNote TS96CD	AST Ascentia A41	Astro PowerMedia III Plus	BSI NP8625A	ChemBook 9750	Compaq Armada 1130T
Price of tested configuration	$2,998 (direct)	$3,330 (street)	$2,999 (direct)	$2,400 (street)	$2,695 (direct)	$2,999 (direct)	$2,960 (street)	$2,400 (street)
System weight/Travel weight (pounds)	7.9, 9.3	6.6, 7.6	7.0, 7.6	7.0, 7.8	7.8, 9.2	8.1, 9.3	7.0, 8.0	6.0, 7.0
Dimensions (HWD, in inches)	2.4 x 11.8 x 10.3	2.0 x 11.5 x 8.8	2.0 x 11.8 x 9.0	2.0 x 11.8 x 9.3	2.4 x 11.8 x 10.3	2.3 x 11.8 x 9.0	2.3 x 12.0 x 9.8	2.1 x 11.9 x 8.9
Motherboard Components								
Processor	Pentium/133	Pentium/120	Pentium/133	Pentium/120	Pentium/166	Pentium/150	Pentium/133	Pentium/120
Installed/maximum system RAM	16MB EDO, 32MB	16MB EDO, 64MB	16MB EDO, 40MB	16MB, 80MB	16MB EDO, 32MB	16MB EDO, 40MB	16MB, 80MB	16MB EDO, 48MB
Installed external RAM cache and type	256K pipelined-burst	256K pipelined-burst	256K pipelined-burst	N/A	256K pipelined-burst	256K synchronous	256K synchronous	N/A
Motherboard manufacturer	Dual Enterprises	Power Computer	Full Power Investment	Samsung	Dual Enterprises	Nan Tan	Chicony	Compaq
Chip set	SiS 5101, 5102, 5103	Intel 82430MX	Intel 82430MX	SiS 5511, 5512, 5513	SiS 5101, 5102, 5103	UMC UM8890	OPTi Viper 82C556, 557, 558N	OPTi Viper 82C556, 557, 558N
Display								
LCD-panel specifications	12.1" active-matrix SVGA	12.1" active-matrix SVGA	12.1" active-matrix SVGA	11.5" dual-scan SVGA	12.1" active-matrix SVGA	12.1" active-matrix SVGA	12.1" active-matrix SVGA	10.6" active-matrix SVGA
Graphics chip set	C&T CT65550	NeoMagic MagicGraph128	NeoMagic MagicGraph128	Cirrus Logic CL-GD7548	C&T CT65550	Trident 9385	C&T CT65550	Cirrus Logic CL-GD7548
Graphics RAM and type	2MB VRAM	1.5MB VRAM	1MB VRAM	1MB EDO DRAM	2MB DRAM	2MB EDO DRAM	2MB EDO DRAM	1MB EDO DRAM
Resolutions and noninterlaced refresh rates supported on external display	800 x 600 at 60 Hz, 1,024 x 768 at 60 Hz	800 x 600 at 72 Hz, 1,024 x 768 at 85 Hz	800 x 600 at 60 Hz, 1,024 x 768 at 60 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 60 Hz, 1,024 x 768 at 60 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 60 Hz	800 x 600 at 85 Hz, 1,024 x 768 at 85 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz
Virtual desktop	■	■	■	■	■	■	■	■
Mass Storage and Multimedia								
Hard disk	Toshiba MK1301MAV	Hitachi DK213A	Maxtor 251350AT	IBM DSOA-21080	Toshiba MK1001MAV	Toshiba MK2101MAN	Toshiba MK1002MAV	Fujitsu M2714T
Installed/maximum hard disk capacity	1.3GB, 2.1GB	1.3GB, 2.1GB	1.3GB, 2.1GB	1GB, 1GB	1GB, 2.1GB	2GB, 2GB	1.3GB, 1.3GB	1GB, 1GB
Floppy disk drive	Swappable	External	Swappable	Swappable	Swappable	Internal	External	Internal
CD-ROM drive (and speed)	Toshiba XM-1402B (6X)	Toshiba XM-1402B (6X)	Torisan CDR-N16 (6X)	Toshiba XM-1402B (6X)	TEAC CD-46E (6X)	Toshiba XM-1402B (6X)	TEAC CD-46E (6X)	None
Sound synthesis	FM	FM	FM	FM	FM	FM	FM	None
Built-in speakers	■	■	■	■	■	■	■	■
Line-in/line-out jacks	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Microphone/speaker/MIDI jacks	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■
NTSC video in/out	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■ (full-size)	■ ■ (full-size)	■ ■
Communications and Expansion								
Type of modem	None	Internal	None	None	None	None	None	None
Speed (data/fax, in Kbps)	N/A	28.8/14.4	N/A	N/A	N/A	N/A	N/A	N/A
Infrared interface	■	■	■	■	■	■	■	■
External keyboard and mouse ports	Both	Shared port	Shared port	Shared port	Both	Shared port	Shared port	Shared port
16550 UART/ECP/EPP support	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
PC Card slots	One Type II/III and one Type II	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	One Type II/III and one Type II	One Type II/III and one Type II	Two Type II or one Type III	Two Type II or one Type III
Full-size alphanumeric/cursor keys	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Type of integrated pointing device	Touch pad	Touch pad	Touch pad	Touch pad	Touch pad	Touch pad	Touch pad	Trackball
Power								
Battery type	Nickel hydride	Lithium ion	Lithium ion	Nickel hydride	Nickel hydride	Nickel hydride	Nickel hydride	Nickel hydride
Rated charge time while on/off (hours:minutes)	2:00, 2:00	3:00, 2:00	4:00, 3:00	4.00, 2:00	1:20, 1:00	4.00, 2:00	4:00, 2:30	2:30, 1:30
Standby/hibernation mode	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Battery hot-swapping/Smart battery	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Service and Support								
Number of dead pixels required for free service or replacement	4; 1 if in center of screen	1 within 30 days, 3 within three years	1 within 30 days, 5 thereafter	3	7	15	Within one month: 4, 2 if adjacent	10 dead or defective pixels, 2 in 1 inch
Standard warranty on parts/labor	1 year/1 year	3 years/3 years	1 year/3 years	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year
On-site service charge (first year)	N/A	N/A	$260.00 maximum	N/A	N/A	N/A	N/A	N/A
24-hour, 7-day live technical support	■	■		■				■
24-hour turnaround for parts replacement	■	■	■					■

N/A—Not applicable: The product does not have this feature

Continues

Dell Latitude LM P-133ST	DFI 6620	DTK DTN-5A120C-2M	Ergo CD-PowerBrick	FutureMate OHP	Gateway Solo 2100-120	HP OmniBook 5500CS	IBM ThinkPad 365X	Jetta JetBook SLIM	Micro Express NP133B
$3,199 (direct)	$2,999 (direct)	$3,000 (street)	$2,995 (direct)	$2,929 (direct)	$2,594 (direct)	$2,570 (street)	$2,610 (street)	$3,000 (street)	$2,699 (direct)
7.0, 7.7	8.0, 9.1	8.2, 9.4	7.7, 8.7	7.1, 8.1	6.8, 7.7	7.1, 8.0	5.8, 6.8	6.3, 7.3	8.0, 9.1
2.0 x 11.8 x 9.0	2.3 x 11.8 x 9.0	2.3 x 11.8 x 9.0	2.3 x 11.8 x 9.3	2.5 x 12.8 x 9.0	2.0 x 11.3 x 8.9	2.1 x 11.8 x 8.9	2.3 x 11.8 x 8.3	1.8 x 11.5 x 8.8	2.3 x 11.8 x 9.0
Pentium/133	Pentium/133	Pentium/120	Pentium/133	Pentium/133	Pentium/120	Pentium/100	Pentium/133	Pentium/120	Pentium/133
16MB EDO, 40MB	16MB EDO, 40MB	16MB EDO, 40MB	16MB, 40MB	16MB, 72MB	16MB EDO, 40MB	16MB, 64MB	16MB EDO, 40MB	16MB, 32MB	16MB EDO, 40MB
256K pipelined-burst	256K pipelined-burst	256K synchronous	256K pipelined-burst	256K synchronous	256K pipelined-burst	256K pipelined-burst	N/A	256K synchronous	256K synchronous
Full Power Investment	Nan Tan	Nan Tan	GVC	Chicony	Quanta	Twinhead	IBM	MiTAC	Nan Tan
Intel 82430MX	UMC UM8890	UMC UM8890	OPTi Viper 82C556, 557, 558N	OPTi Viper 82C556, 557, 558N	Intel 82430MX	OPTi Viper-N	Intel 82430MX	UMC UM8890	UMC UM8890
12.1" active-matrix SVGA	12.1" active-matrix SVGA	10.5" active-matrix SVGA	12.1" active-matrix SVGA	10.4" active-matrix SVGA	11.3" dual-scan SVGA	11.3" dual-scan SVGA	11.3" dual-scan SVGA	11.3" active-matrix SVGA	12.1" active-matrix SVGA
NeoMagic MagicGraph128	Trident 9385	Trident 9385	Cirrus Logic CL-GD7543	C&T CT65548	Cirrus Logic CL-GD7548	C&T CT65548	Trident Cyber 9320	C&T CT65548	Trident 9385
1MB EDO DRAM	2MB EDO DRAM	2MB DRAM	2MB DRAM	1MB DRAM	1MB EDO DRAM	1MB DRAM	1MB VRAM	1MB VRAM	2MB VRAM
800 x 600 at 85 Hz, 1,024 x 768 at 60 Hz	800 x 600 at 72 Hz, 1,024 x 768 at 72 Hz	800 x 600 at 72 Hz, 1,024 x 768 at 72 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 60 Hz, 1,024 x 768 at 60 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 72 Hz, 1,024 x 768 at 72 Hz
■	■	■	■	■	■	■	■	■	■
IBM DMCA-21440	Toshiba MK1001MAV	Toshiba MK2720FC	Toshiba MK1301MAV	Maxtor 251350AT	IBM DSOA-20810	Toshiba MK2720FC	IBM DSOA-21080	Toshiba MK1301MAV	Maxtor 251350AT
1.3GB, 1.3GB	1GB, 2GB	1.3GB, 2GB	1.3GB, 2.1GB	1.3GB, 2.1GB	774MB, 1.3GB	1.3GB, 2GB	1GB, 1.3GB	1.3GB, 4GB	1.3GB, 2.1GB
Swappable	Internal	Internal	Internal	External	Swappable	External	Internal	Swappable	Internal
Torisan CDR-N16 (6X)	Toshiba XM-1402B (6X)	Toshiba XM-1402B (6X)	TEAC CD-46E (6X)	TEAC CD-46E (6X)	TEAC CD-46E (6X)	Toshiba XM-1302B (4X)	None	TEAC CD-46E (6X)	Toshiba XM-1402B (6X)
FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
■	■	■	■	■	■	■	■	■	■
■ ■	■ ○	■ ■	■ ○	○ ■	○ ■	■ ■	■ ○	■ ○	■ ■
■ ■ ○	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ○	■ ○ ○	■ ○ ■	■ ○ ○	■ ■ ○	■ ○ ■
○ ○	○ ■ (requires adapter)	○ ■ (requires adapter)	○ ■ (full-size)	○ ○	○ ○	○ ■ (full-size)	○ ○	○ ○	○ ○
None	None	PC Card	PC Card	None	None	None	None	None	PC Card
N/A	N/A	28.8/28.8	28.8/14.4	N/A	N/A	N/A	N/A	N/A	28.8/14.4
■	■	■	■	■	■	■	■	■	■
Shared port	Shared port	Shared port	Shared port	Shared port	Shared port	Shared port	Shared port	Shared port	Shared port
■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ○	■ ■ ■	■ ■ ■	■ ■ ■
Two Type II or one Type III	One Type II/III and one Type II	One Type II/III and one Type II	One Type II/III and one Type II	One Type II/III and one Type II	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	One Type II/III and one Type II
■ ○	○ ○	○ ○	■ ■	○ ○	■ ○	○ ○	■ ○	○ ○	○ ○
Touch pad	Touch pad	Touch pad	Touch pad	Touch pad	Touch pad	Pointing stick	Pointing stick	Touch pad	Touch pad
Lithium ion	Nickel hydride	Nickel hydride	Nickel hydride	Lithium ion	Lithium ion	Lithium ion	Nickel hydride	Nickel hydride	Nickel hydride
4:00, 3:00	4.00, 2:00	4.00, 2:00	1:15, 0:45	3:00, 2:00	3:00, 1:30	5:20, 4:00	1:30, 1:10	8:00, 1:45	4:00, 2:00
■ ■	■ ○	■ ○	■ ■	■ ■	■ ○	○ ○	■ ■	■ ■	■ ○
■ ■	○ ■	○ ■	○ ○	○ ■	○ ○	■ ■	■ ○	○ ○	○ ■
4 in an area the size of a quarter	10	2	4 in one quadrant	10	Case-by-case decision	4 in an area the size of a thumb	21	4; fewer if clustered	25; 3 if adjacent
3 years/1 year	1 year/3 year	1 year/1 year	4 years/4 years	1 year/1 year	1 year/1 year	3 years/3 years	1 year/1 year	1 year/1 year	2 years/2 years
$99.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
■	○	○	■	○	■	○	■	○	■
■	○	○	■	■	○	○	■	○	■

SUMMARY OF FEATURES

Value Notebooks

■ YES NO In alphabetical order by company	Mobile Office MOS8600CDT	NEC Versa 2435CD	Sceptre SoundX S4000T	Sharp PC-9030	TI Extensa 605CD	Toshiba Satellite Pro 430CDS (PC MAGAZINE EDITORS' CHOICE)	Twinhead Slimnote 710CV
Price of tested configuration	$2,795 (direct)	$3,000 (street)	$3,000 (street)	$3,000 (street)	$2,650 (street)	$2,500 (street)	$2,019 (direct)
System weight/Travel weight (pounds)	8.0, 9.1	7.6, 8.6	6.9, 7.5	7.0, 7.9	6.5, 7.4	7.0, 7.3	5.6, 6.2
Dimensions (HWD, in inches)	2.3 x 11.8 x 9.0	2.3 x 11.8 x 9.5	2.0 x 11.8 x 9.0	2.1 x 11.6 x 8.8	1.9 x 11.9 x 9.4	2.2 x 11.8 x 9.3	1.3 x 11.6 x 9.3
Motherboard Components							
Processor	Pentium/133	Pentium/133	Pentium/133	Pentium/120	Pentium/120	Pentium/120	Pentium/100
Installed/maximum system RAM	16MB EDO, 40MB	16MB EDO, 48MB	16MB EDO, 40MB	16MB EDO, 64MB	16MB EDO, 64MB	16MB EDO, 48MB	16MB EDO, 40MB
Installed external RAM cache and type	256K synchronous	N/A	256K pipelined-burst	256K synchronous	N/A	N/A	N/A
Motherboard manufacturer	Nan Tan	FIC	Full Power Investment	Twinhead	Acer	Toshiba	Twinhead
Chip set	UMC UM8890	UMC UM8890	Intel 82430MX	SiS 5101, 5102, 5103	Acer ALI3	Toshiba T6W23A	SiS 5101, 5102, 5103
Display							
LCD-panel specifications	10.4" active-matrix SVGA	11.3" dual-scan SVGA	12" active-matrix SVGA	11.3" active-matrix SVGA	12.1" dual-scan SVGA	11.3" dual-scan SVGA	11.3" dual-scan SVGA
Graphics chip set	Trident 9385	C&T CT65548	NeoMagic MagicGraph128	Cirrus Logic CL-GD7543	C&T CT65550	C&T CT65550	Cirrus Logic CL-GD7543
Graphics RAM and type	2MB EDO DRAM	1MB VRAM	1MB DRAM	1MB VRAM	1MB DRAM	2MB EDO DRAM	1MB EDO DRAM
Resolutions and noninterlaced refresh rates supported on external display	800 x 600 at 72 Hz, 1,024 x 768 at 72 Hz	800 x 600 at 72 Hz, 1,024 x 768 at 72 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 60 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 85 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz
Virtual desktop	■		■			■	
Mass Storage and Multimedia							
Hard disk	Toshiba MK1002MAV	IBM DSOA-21080	Toshiba MK1926FCV	Fujitsu M2714T	IBM DSOA-20810	Toshiba MK1301MAV	Toshiba MK1926FCV
Installed/maximum hard disk capacity	1GB, 2.1GB	1GB, 1.1GB	776MB, 1.3GB	1.1GB, 1.1GB	774MB, 812MB	1.3GB, 1.3GB	776MB, 1.4GB
Floppy disk drive	Internal	Swappable	Swappable	Swappable	External	Swappable	Internal
CD-ROM drive (and speed)	Toshiba XM-1402B (6X)	Torisan CDR-N16 (6X)	Torisan CDR-N16 (6X)	Matsushita UJDCD6730 (6X)	Matsushita UJDCD6700 (6X)	Toshiba XM-1502B (10X)	None
Sound synthesis	FM	FM	FM	FM	FM	FM	FM
Built-in speakers	■	■	■	■	■	■	■
Line-in/line-out jacks	■	■■		■■	■■	■■	■■
Microphone/speaker/MIDI jacks	■■■	■	■■	■ ■	■	■	■ ■
NTSC video in/out				■ (full-size)			
Communications and Expansion							
Type of modem	PC Card	None	None	None	None	None	None
Speed (data/fax, in Kbps)	28.8/14.4	N/A	N/A	N/A	N/A	N/A	N/A
Infrared interface	■	■	■	■	■	■	■
External keyboard and mouse ports	Two shared ports	Shared port	Shared port	Shared port	Shared port	Shared port	Keyboard or mouse
16550 UART/ECP/EPP support	■■■	■■■	■■■	■■■	■■■	■■	■■■
PC Card slots	One Type II/III and one Type II	Two Type II or one Type III	One Type II or one Type III	Two Type II or one Type III	One Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III
Full-size alphanumeric/cursor keys		■	■	■■	■	■■	■
Type of integrated pointing device	Touch pad	Touch pad	Touch pad	Touch pad	Touch pad	Pointing stick	Touch pad
Power							
Battery type	Nickel hydride	Nickel hydride	Lithium ion	Lithium ion	Nickel hydride	Lithium ion	Nickel hydride
Rated charge time while on/off (hours:minutes)	4:00, 2:00	6:00, 3:00	4:00, 3:00	6:00, 2:00	9:00, 2:00	8:00, 2:30	4:00, 2:00
Standby/hibernation mode		■■	■■	■■	■■	■■	■
Battery hot-swapping/Smart battery	■	■■	■	■■	■	■	■
Service and Support							
Number of dead pixels required for free service or replacement	2	3	9 (varies depending on screen manufacturer)	No set policy	6; 2 if adjacent	Case-by-case decision	2 if adjacent; 4 in a 1-inch square; otherwise 24
Standard warranty on parts/labor	4 years/4 years	1 year/1 year	3 years/3 years	3 years/3 years	1 year/1 year	3 years/3 years	1 year/1 year
On-site service charge (first year)	$185.00	N/A	N/A	N/A	N/A	$49.95	N/A
24-hour, 7-day live technical support	■	■		■	■	■	
24-hour turnaround for parts replacement		■	■ (first month only)	■			

N/A—Not applicable: The product does not have this feature

Ends	Wedge Showbiz-5000	WinBook FX
	$2,600 (street)	$2,999 (direct)
	6.9, 7.9	7.6, 8.4
	2.3 x 12.0 x 9.0	2.3 x 11.3 x 8.9
	Pentium/100	Pentium/133
	16MB, 72MB	16MB EDO, 40MB
	256K asynchronous	256K pipelined-burst
	Chicony	Quanta
	OPTi Viper 82C556, 557, 558N	Intel 82430MX
	10.4" active-matrix SVGA	11.3" active-matrix SVGA
	C&T CT65548	Cirrus Logic CL-GD7543
	1MB DRAM	1MB DRAM
	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz	800 x 600 at 75 Hz, 1,024 x 768 at 75 Hz
	■	■
	Toshiba MK1301MAV	Toshiba MK1926FCV
	1.3GB, 4.2GB	776MB, 2GB
	External	Swappable
	TEAC CD-46E (6X)	TEAC CD-46E (6X)
	FM	FM
	■	■
	■■	■■
	■■■	■■■
	■■	■■
	None	Integrated
	N/A	28.8/14.4
	■	■
	Two shared ports	Shared port
	■■■	■■■
	One Type II/III and one Type II	One Type II/III and one Type II
	■■	■■
	Touch pad	Pointing stick
	Lithium ion	Lithium ion
	4:00, 2:00	6:00, 4:00
	■■	■■
	■■	■■
	8	12; 5 if clustered
	1 year/3 years	1 year/1 year
	$299.00	N/A
	■	■
	■	■

DFI Inc.

DFI 6620

DFI's $2,999 (direct) DFI 6620 is a fine Pentium/133-based value notebook with a 1GB Toshiba hard disk and a 12.1-inch active-matrix display. Intended as a general-purpose notebook for everyone from students to salespeople, the 9.1-pound (travel weight) DFI 6620 clearly demonstrated that well-matched components pay off in good performance.

Nan Tan Computer manufactures the DFI 6620. The unit is built around a Nan Tan motherboard and a UMC chip set with a SystemSoft BIOS, 256K of pipelined-burst L2 cache, and EDO DRAM. The DFI 6620 posted average mostly results for its processor class.

The above-average showing on our Graphics WinMark 97 tests is attributable to the Trident 9385 graphics engine with 2MB of EDO DRAM. This setup runs the internal display at 800-by-600 resolution and can run an external monitor at 1,024-by-768 resolution. The DFI 6620's Toshiba 6X CD-ROM drive posted one of the higher scores on the CD-ROM WinMark 97 test program. Another interesting feature is the standard NTSC video-out port.

Providing typical performance for a portable of this speed, the DFI 6620's nickel hydride battery charges in 2 hours with the power off and lasted 1:40 on our BatteryMark test.

The DFI 6620 delivers the right performance for the right price, needing only a lithium ion battery for longer running time away from AC power.—*BB*

DFI 6620. Direct price: $2,999. DFI Inc., Fremont, CA; 800-334-1196, 510-657-5678; fax, 510-657-5685; www.dfi.net. *Circle 450 on reader service card.*

DTK Computer Inc.

DTK DTN-5A120C-2M

DTK Computer's $3,000 (street) DTK DTN-5A120C-2M is targeted at business travelers who need good performance, reliability, and speed. The unit has a 120-MHz Pentium CPU, a 10.4-inch active-matrix display, a 1.3GB Toshiba hard disk, and a 6X CD-ROM drive. But of the several units in this roundup that are built by Nan Tan Computer Co., it is less competitive than some in terms of performance and features.

The DTK notebook uses a UMC chip set, 256K of synchronous L2 cache, and EDO DRAM. The 9.4-pound (travel weight) unit is a bit hefty, but it produced average scores on our CPUmark and Disk WinMark 97 tests. It also made above-average showings on the Graphics WinMark 97 and Winstone 97 test programs, thanks in part to its Trident 9385 graphics adapter with 2MB of EDO DRAM. This video setup runs the internal display at Super VGA resolution.

The unit's nickel hydride battery, rated to charge in 1 hour with power on or off, lasted for 1:45 on our BatteryMark test. In addition to the 28.8-Kbps fax modem, the DTK comes with Microsoft Games for Windows 95.

Other vendors reviewed here sell essentially the same machine but for less money and with additional features. It is difficult to recommend the DTK DTN-5A120C-2M because of its slower CPU and its small screen.—*BB*

DTK DTN-5A120C-2M. Street price: $3,000. DTK Computer Inc., City of Industry, CA; 800-289-2385; fax, 818-810-0090; www.dtkcomputer.com. *Circle 451 on reader service card.*

Intel Power Monitor Keeps Apps in Line

By Nick Stam

Did you know that whether you are typing fast or slow (even as slow as one character every 5 seconds) in your Microsoft Word document, your notebook PC is using *100 percent* of its CPU power? In fact, many Windows applications wait for user input by implementing *spin-loops* that constantly poll the message queue for messages—and keep the CPU running at full speed—rather than simply idling until Windows tells the program that a message is waiting. Also, some device drivers appear active to Windows while waiting for certain events to occur, which also keeps the CPU on high.

Intel's Mobile Technology Labs has just the solution for identifying and correcting the behavior of many types of ill-behaved or power-unfriendly applications and drivers: the Intel Power Monitor (IPM). This software utility is free and can be downloaded (*www.intel.com/ial/ipm*). Both end-user and developer versions are available.

NOTEBOOK POWER MANAGEMENT: GOOD ENOUGH?

Many different power management features are used in notebooks. Disk, screen, and standby timeout settings are most common, as are CPU speed settings. Many notebooks let you set the CPU speed to maximum all the time or allow it to slow when applications are idle. In some cases the CPU can temporarily halt, or enter a *stop-clock state,* with a 1- to 2-watt power consumption to keep the L1 caches and certain phase-lock loops alive.

Applications that are ill behaved will not permit the notebook to use its power management effectively. A common spin-loop technique to check the message queue uses the Windows API function called PeekMessage. Unlike the less greedy and more multitasking-friendly GetMessage function, which returns control to Windows if no queued messages exist for the application, the PeekMessage function returns control to the application in all cases.

The failure to return control to the OS prevents certain low-level power-management functions from kicking in. PeekMessage loops have been used for some time and with older CPUs such as 386s; they allow faster servicing of input messages. Windows 3.*x* developers also used them to allow background processing in their applications because preemptive multitasking wasn't supported. Today, well-designed Windows 95 apps take advantage of the OS's preemptive multitasking feature and implement background tasks as separate threads that are scheduled by the OS. Using PeekMessage is no longer good practice.

IT REALLY WORKS

The end-user version of IPM actually patches the OS to allow the PeekMessage call to yield control to OS for a certain amount of time, permitting power management to work more effectively. According to Intel, the user shouldn't notice any difference in application behavior. IPM can also detect and display smart battery information (if it is installed).

Ziff-Davis Benchmark Operation developers tested the Intel Power Monitor with Microsoft Word and noted a significant reduction in CPU usage (compared with not running the patch) during a test that required 260 words typed at the keyboard. The patch occurs only at runtime and patches only memory space—not disk files—so the OS and applications are not permanently altered.

The developer version provides insights and examples for developers to build power-friendly applications. The IPM utility is also useful for desktop PCs that implement stop-clock features, because the CPU will run cooler.

Ergo/The Brick Computer Co. Inc.

CD-PowerBrick

The CD-PowerBrick, from Ergo/The Brick Computer Co., has a direct price of $2,995 and is positioned as an all-purpose, moderately powerful desktop-replacement system. The 133-MHz CD-PowerBrick had low benchmark test scores compared with similar machines, but a 12.1-inch active-matrix display, a 1.3GB Toshiba hard disk, a four-year warranty, and a bundled 28.8/14.4-Kbps fax modem tip the scales back in its favor.

One advantage of this 8.7-pound (travel weight) unit is that it houses a 6X CD-ROM drive and a floppy disk drive simultaneously. The CD-PowerBrick uses a GVC motherboard with OPTi's Viper chip set and 256K of pipelined-burst L2 cache. The system's CPUmark and Winstone 97 scores were below average, but its Disk WinMark 97 and CD-ROM WinMark 97 scores were average. A Cirrus Logic graphics adapter with 2MB of DRAM can show 64,000 colors at 800-by-600 resolution on the internal display. The Ergo CD-PowerBrick's Graphics WinMark 97 score was below the average, however.

The nickel hydride battery lasted for 1:48 on our BatteryMark test. A $99 upgrade to a lithium ion battery is likely to add another hour of battery life.

If top performance isn't as important to you as a solid system for general-purpose computing, the CD-PowerBrick is a good choice.—*BB*

CD-PowerBrick. Direct price: $2,995. Ergo/The Brick Computer Co. Inc., Peabody, MA; 800-495-3746, 508-535-7510; fax, 508-535-7512; www.ergo-computing.com. *Circle 452 on reader service card.*

SUITABILITY TO TASK	Ergo CD-PowerBrick
Desktop replacement	Good
Road warrior	Good

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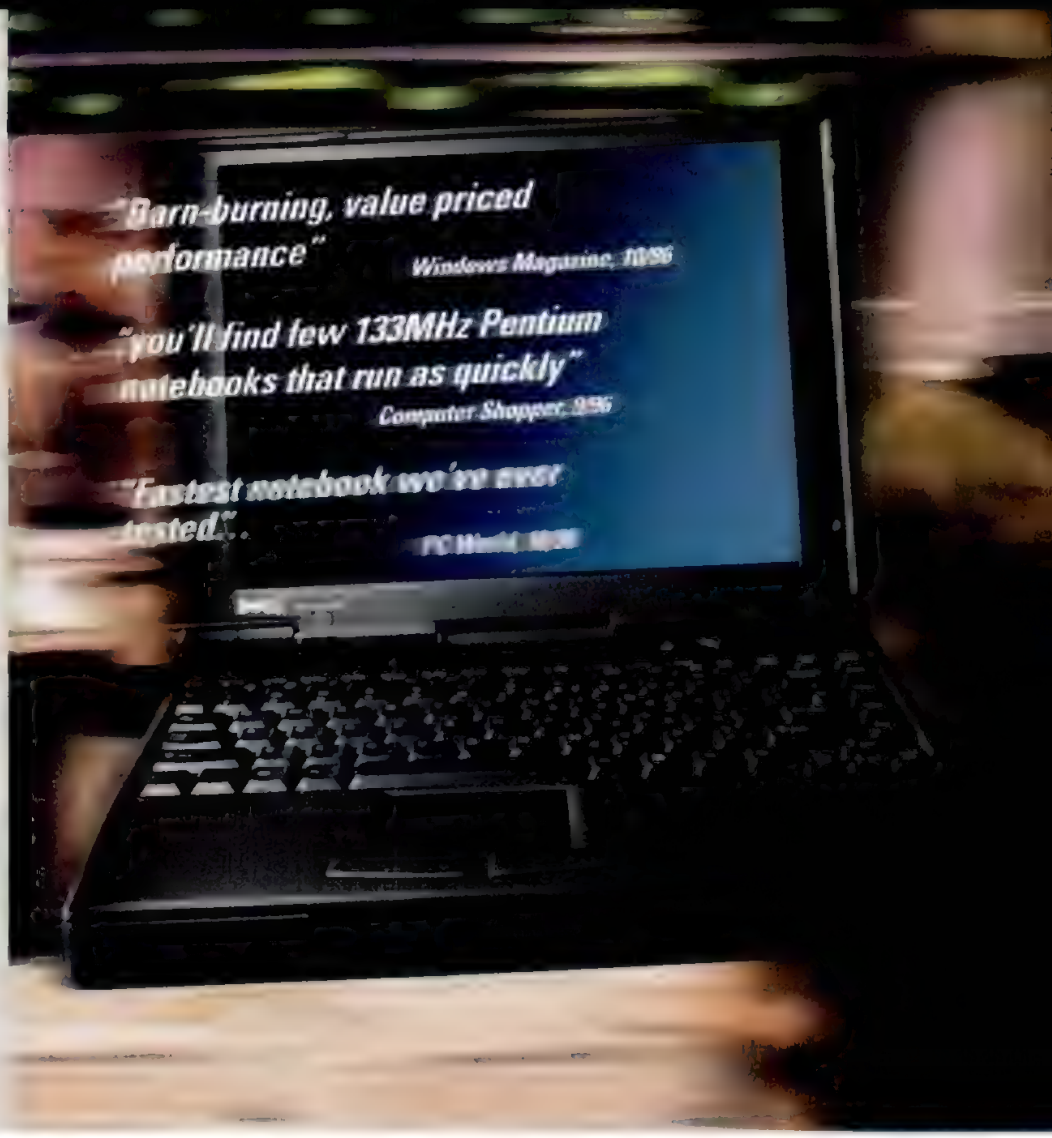

Yes, the Dell Latitude LM P133ST is fast. Blisteringly so, thanks to an optimized combination of PCI bus, 133MHz processor and 128-bit Neomagic PCI video controller. But speed isn't everything, so we've endowed it with a stunning 12.1" active matrix screen. And battery life that just won't quit thanks to Lithium Ion technology and Dell's Power Management software. By the way, there's one more feature guaranteed to make this notebook go fast. The price. So hurry up and call us to order one today.

intel inside pentium PROCESSOR

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FutureTech Systems Inc.

FutureMate OHP

FutureTech Systems' $2,929 (direct) FutureMate OHP is targeted at marketing executives and others who need a machine for presentations. Equipped with a 1.3GB hard disk and a 6X TEAC CD-ROM drive, the 133-MHz Pentium system has a 10.4-inch active-matrix display that flips up to work with an LCD projection system. For users outside the presentation market, the FutureMate OHP's price is a bit high given its relatively low test scores and its smaller-than-optimal screen.

Chicony Electronics manufactures the 8.1-pound (travel weight) FutureMate OHP, which uses a Chicony motherboard, an OPTi chip set, a Phoenix BIOS, and 256K of synchronous L2 cache. The system's Winstone 97 and Disk WinMark 97 scores were average, but its CPUmark score was below average. An above-average CD-ROM WinMark score represented the performance peak.

A Chips & Technologies 65548 graphics adapter with 1MB of DRAM delivered a below-average Graphics WinMark 97 score. But it can run the internal display at 800-by-600 resolution with 64,000 colors, and it can power an external monitor at the same resolution at 75 Hz.

Fitted with a lithium ion battery (which charges in 2 hours with the power off), the FutureMate OHP ran for 1:48 on our BatteryMark test.

The FutureMate OHP is a good choice if you need a decent system for use with an overhead projector. Otherwise, competing systems may provide you with better value.—*BB*

FutureMate OHP. Direct price: $2,929. FutureTech Systems Inc., Hackensack, NJ; 800-275-4414, 201-488-4414; fax, 201-488-4405; www.futuretec.com. *Circle 453 on reader service card.*

SUITABILITY TO TASK

Gateway Solo 2100-120

Desktop replacement	Good
Road warrior	Good

Gateway 2000 Inc.

Gateway Solo 2100-120

Though Gateway 2000 builds its Solo 2100-120 to customer specifications, the $2,594 (direct) tested machine targets corporate users on a budget. The Pentium/120-based notebook boasts a fast (though comparatively small) hard disk and a respectable battery life. Gateway ships this decent performer to your door at a minimal price and with a healthy software bundle.

SERVICE & RELIABILITY

Gateway 2000

Reliability	Average
Repair	Average
Technical support	Better than average
Percent needing repair	Average

The Solo has a travel weight of 7.7 pounds. Its adequate palm rest holds both an EZ Pad touch pad and a set of stereo speakers backed by FM synthesis; the screen is an 11.3-inch dual-scan display. The 6X CD-ROM drive fits into a modular bay that can handle the floppy disk drive or a second battery (the latter is not included). A face plate, a hollow piece of plastic, keeps the bay dust-free when not in use.

The Solo's 774MB IBM hard disk led to an above-average Disk WinMark 97 score. With a mobile Triton chip set and 256K of pipelined-burst cache, the machine's Winstone and CPUmark scores were above the average. The Cirrus Logic graphics chip set with 1MB of EDO DRAM contributed to an average Graphics WinMark score. The lithium ion battery lasted for 2:25 on our BatteryMark test.

The PC Card bay supports one Type III or two Type II cards; the unit also offers a full set of I/O ports, including 115.2-Kbps infrared and audio. The Solo is also one of the few units here to support Zoomed Port Video. (A ZPV PC Card is an extra $199.)

Gateway also provides a prime software bundle, which includes Ascend's PIM, Microsoft Works, and LapLink, as well as a set of Koss headphones. The Solo's only weakness is its comparatively small hard disk. At its price point, however, this portable is a worthwhile purchase for any value-conscious buyer.—*CM*

Gateway Solo 2100-120. Direct price: $2,594. Gateway 2000 Inc., North Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023; www.gw2k.com. *Circle 454 on reader service card.*

Hewlett-Packard Co.

HP OmniBook 5500CS

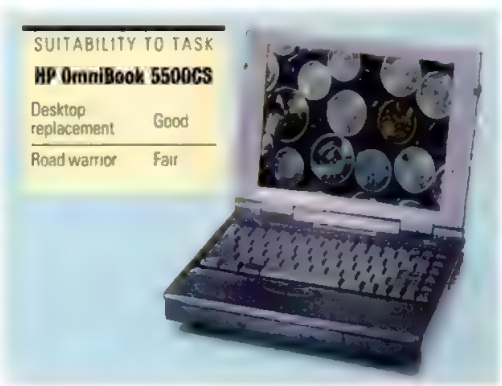
The $2,570 (street) HP OmniBook 5500CS, from Hewlett-Packard, sets itself apart with two features: a 4-Mbps Fast IrDA interface and an NTSC video-out port. Although it affords you only a Pentium/100, the bluish-gray portable is attractive and well built and performs on a par with this roundup's Pentium/120 machines. Despite the unit's visual appeal, reminiscent of current home-market desktop trends, HP is marketing the OmniBook as a corporate mobile system.

The unit features an 11.3-inch dual-scan display and weighs 8 pounds (travel

SUITABILITY TO TASK

FutureMate OHP

Desktop replacement	Good
Road warrior	Fair



SUITABILITY TO TASK

HP OmniBook 5500CS

Desktop replacement	Good
Road warrior	Fair

Monkey on your back #41: How to choose the hardware when you've already chosen Windows NT®.

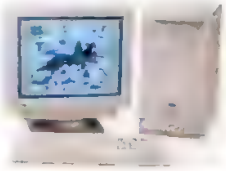
intel inside
PENTIUM PRO PROCESSOR

If you're compiling a short list of Windows NT® hardware, based on the Intel® Pentium® or Pentium Pro Processor, take note: Only one – Digital – has developed a line of servers, workstations, desktops, and notebooks that was literally born to run Windows NT.

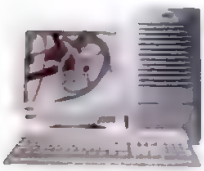
HiNote™ Ultra II

One more point to jot down: Our heritage in multi-vendor integration and enterprise-level computing makes us uniquely qualified to help you migrate smoothly to this robust operating system. Add the fact that we have utilized our alliance with Microsoft® to offer you unparalleled service and support, and your choice becomes even easier. Remember, you chose Windows NT to let your users access mission-critical data from their desktops and notebooks.

Prioris™ ZX



Celebris™ GL



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weight). The keys are slightly less than full-size (18.4 mm). The pointing stick uses the latest TrackPoint III technology from IBM.

The OmniBook offers 256K of pipelined-burst cache and 16MB of standard DRAM. With these components as well as a 64-bit Chips & Technologies graphics subsystem and a 1.3GB Toshiba hard disk, most of its test scores were average. The unit's 4X Toshiba CD-ROM drive (occupying a modular bay that also accommodates a floppy disk drive or an optional $300 second battery) was competing against 6X drives and therefore turned in a relatively low CD-ROM WinMark 97 score. The system's lithium ion battery lasted a respectable 2 hours 12 minutes on our BatteryMark test.

In addition to its cutting-edge I/O—the Fast IR port for 4-Mbps file transfers, the NTSC video-out port, and a software package to go with the latter feature—the system provides the standard I/O ports as well as audio ports. There is also a port to connect you to an optional $650 docking station.

SERVICE & RELIABILITY	
Hewlett-Packard	
Reliability	Average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Average

The HP OmniBook 5500CS is a well-designed machine offered at a good price.—*CM*

HP OmniBook 5500CS. Street price: $2,570. Hewlett-Packard Co., Palo Alto, CA; 800-322-4772; www.hp.com/go/omnibook. *Circle 455 on reader service card.*

IBM Corp.

ThinkPad 365X

SUITABILITY TO TASK	
ThinkPad 365X	
Desktop replacement	Fair
Road warrior	Good

Though IBM is known for its cutting-edge notebook designs, its value-class portables usually trail the pack in terms of bang for the buck. In fact, IBM provided the $2,610 (street) ThinkPad 365X with no secondary cache, active-matrix display, or lithium ion battery, in order to meet our price limit. But although this 133-MHz portable is a poor performer, it does have a relatively light travel weight and ships with one of the best software bundles we saw in this roundup. IBM targets corporate salespeople as well as cost-conscious small-business and home users with this unit.

The 6.8-pound (travel weight) system includes an 11.3-inch dual-scan display and a 1GB IBM hard disk. The latter led to one of the few successes in the ThinkPad's benchmark test results: an average Disk WinMark 97 score. The lack of an L2 cache held most other scores to significantly below the average. But the nickel hydride battery delivered, attaining a BatteryMark timing of 2:10.

The ThinkPad features a TrackPoint III pointing stick as well as a single speaker with an external volume control. The most glaring lack in the ThinkPad's exterior design is the absence of a palm rest, although it does have a comfortable full-size keyboard and two feet in the rear to incline the notebook.

SERVICE & RELIABILITY	
IBM	
Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Average

In order to make it under our price limit, the ThinkPad does without a CD-ROM drive. Yet there are pluses: a 115.2-Kbps infrared port, audio jacks, and a terrific software bundle that includes IBM's NetFinity, Lotus SmartSuite, TranXit, and IntelliLink Connect. In a roundup of sub-$3,000 machines, such a bundle is anomalous.

Although this system does have a few attractive features, others may provide more overall value.—*CM*

ThinkPad 365X. Street price: $2,610. IBM Corp., Armonk, NY; 800-426-2968, 914-766-1900; fax, 800-426-3395; www.ibm.com. *Circle 456 on reader service card.*

Jetta International Inc.

JetBook SLIM

The biggest advantages of Jetta International's $3,000 (street) Pentium/120-based JetBook SLIM are its relatively small size and weight. The unit also provides a good deal of value for the money. But unlike most notebooks, this one has the battery screwed in place, making it nearly impossible to swap out easily.

The JetBook is smaller than most notebooks (just 1.8 inches thick) and weighs 7.3 pounds (travel weight). The C&T 65548 graphics adapter with 1MB of VRAM can handle Super VGA resolution at 64K internally. The unit also has 256K of synchronous L2 cache, an 11.3-inch TFT display, a 1.3GB hard disk, a 6X CD-ROM drive (8X is now standard), and a bundled 28.8-Kbps PC Card fax modem (a 33.6/14.4-Kbps model is now standard). The system fared well on our tests for its CPU class, earning mostly average scores, with an above-average result on the CD-ROM WinMark 97 tests.

The unit's nickel hydride battery lasted 1:56 in our testing. To remove it, you must remove the palm rest and loosen two screws. If you're running on battery power, you should save your work frequently (although doing so will use up the battery sooner), because if the power becomes low, you probably won't have time to swap out the battery before it dies.

The JetBook SLIM is an attractively compact unit and a competent performer. Its hard-to-replace battery calls for a real caveat emptor, however.—*BB*

JetBook SLIM. Street price: $3,000. Jetta International Inc., Monmouth Junction, NJ; 908-329-9651; fax, 908-329-0105; www.jetta.com. *Circle 457 on reader service card.*

SUITABILITY TO TASK	
Jetta JetBook SLIM	
Desktop replacement	Good
Road warrior	Poor

What Would You Call A Stereo You Can Fax On, A CD Player You Can Talk On And A High-Speed Modem You Can Watch Movies On, Except Cool?

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PremierSound Audio System for the ultimate sound in a multimedia notebook

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128-bit graphics and superfast MPEG full screen and full-motion video on a large 11.3" display

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Integrated 33.6Kbps data modem provides the fastest Internet access available over standard phone lines*

Introducing The Compaq Presario 1000 Series

What do you look for in a multimedia notebook? A powerful 133MHz Pentium® processor? Absolutely. High capacity hard drives? Sure. But really, when you boil it all down, don't you just want it to be able to work and play as hard as you do?

Introducing the Compaq Presario 1000 Series. It's pretty much everything you could ever want in one neat little multimedia package. High-speed CD-ROM. Fast modem*. A PremierSound Audio System with Easy Access Buttons that make it work just like your stereo. And a full duplex speakerphone.

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COMPAQ

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Micro Express

Micro Express NP133B

The $2,699 (direct) Micro Express NP133B is aimed at sales and marketing professionals who want a competent, mobile presentation machine that can serve as a desktop replacement. The 133-MHz Pentium-based NP133B, in fact, is a good deal for almost anyone. Its battery life was subpar, however.

Weighing in for travel at 8 pounds, the unit came stocked with a Nan Tan motherboard, EDO DRAM, and 256K of synchronous L2 cache. It also features a 12.1-inch active-matrix display and a 28.8-Kbps PC Card fax modem.

The unit did a fine job in benchmark testing. The UMC chip set performed well, though it didn't quite attain the levels reached by the Intel Mobile Triton set in other notebooks. In Graphics WinMark 97 testing, the system's Trident 9385 graphics adapter with 2MB of VRAM was an average performer; it offers Super VGA resolution internally. The 1.3GB Maxtor hard disk and the 6X Toshiba CD-ROM drive helped the unit earn its best scores: above-average results on our Disk WinMark 97 and CD-ROM WinMark 97 tests.

Micro Express expects a lithium ion battery to be available with the unit by the end of the year, which will be a welcome addition. The current nickel hydride battery lasted for a disappointing 1:20 on our BatteryMark test.

The NP133B's combination of price and features is attractive, but its battery life may turn away some.—*BB*

Micro Express NP133B. Direct price: $2,699. Micro Express, Irvine, CA; 800-989-9900, 714-852-1400; fax, 714-852-1225; www.microexpress.net. *Circle 458 on reader service card.*

Mobile Office Systems

MOS8600CDT

Mobile Office Systems' MOS-8600CDT, a $2,795 (direct) Pentium/133-based system, is intended for professionals and other power users who want a midlevel system and don't need the largest screen. The unit offers a successful blend of features, performance, price, and support, although its battery life is short, at only 1 hour. Mobile Office Systems started out by reselling brand-name portables nine years ago. It brought out its own line of notebooks four years ago.

The 9.1-pound (travel weight) MOS-8600CDT has a UMC chip set, 256K of synchronous L2 cache, and EDO DRAM. The system also features a 10.4-inch active-matrix display (an 11.3-inch screen is now available at no extra cost) and a bundled PC Card 28.8-Kbps fax modem (a 33.6-Kbps modem is now standard).

The MOS unit's graphics subsystem is built around a Trident 9385T graphics adapter that has 2MB of EDO DRAM, which allows for Super VGA resolution with 16.7 million colors internally. The unit supports Zoomed Port Video.

The unit did well on our tests, garnering mostly average scores. Its CD-ROM WinMark 97 score was above average, thanks to the 6X Toshiba CD-ROM drive. The nickel hydride battery, however, lasted only 1 hour on our BatteryMark test.

The system comes with a four-year warranty. During the first year, Mobile Office Systems offers depot service. In years two through four, GE Extended On-Site is the provider and includes on-site service.

In view of the MOS8600CDT's long warranty but also its small screen—and in the light of the competition—this notebook is a reasonable but not terrific value.—*BB*

MOS8600CDT. Direct price: $2,795. Mobile Office Systems, Fullerton, CA; 888-446-4667, 714-525-4090; fax, 714-525-4093. *Circle 459 on reader service card.*

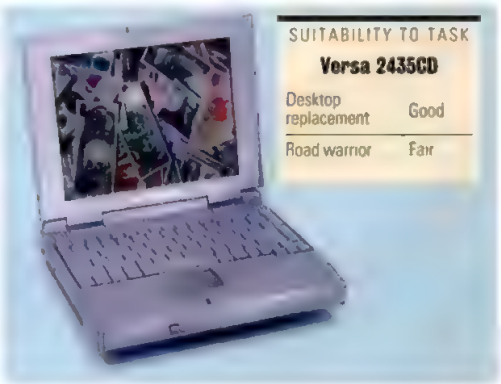
NEC Computer Systems Division

Versa 2435CD

NEC's $3,000 (street) Versa 2435CD is intended to appeal to a wide audience: mobile sales users, corporate fleet buyers, SOHO users, and students. Although the system comes with a 133-MHz processor, the Versa 2435CD's 11.3-inch dual-scan color display and its lack of a secondary cache diminish its value. This notebook is difficult to recommend when other companies sell fine systems with larger, active-matrix displays and with fast cache for the same price.

The 8.6-pound (travel weight) Versa 2435CD features a 1GB IBM hard disk, a UMC chip set, EDO DRAM, and a Sanyo 6X CD-ROM drive. A Chips & Technologies 65548 graphics adapter runs the internal display at Super VGA (1,024-by-768) resolution. The system also features two bays for modular components, each of them capable of accommodating a floppy disk drive, a CD-ROM drive, a second battery, or an AC power pack.

Because the unit lacked an L2 cache, its performance took hits. Although its hard disk and CD-ROM drive helped it secure average scores on the relevant tests, other



SERVICE & RELIABILITY	
NEC	
Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Average

results were below average.

The lower power demands of dual-scan screens pay off in battery life. The system's nickel hydride battery lasted for 1:56 on our BatteryMark test. The Versa 2435CD also adds some value and distinguishes itself from other notebooks through its software bundle, which includes Microsoft Works and Home, McAfee WebScan and VirusScan, LapLink, and NetCruiser Plus. The system we tested did not come with a modem.

NEC's standard warranty (Ultra Care) includes pickup and return service during the first year of ownership, including 24-hour turnaround.

Because of the dual-scan display and the lack of L2 cache, and given the competition, the Versa 2435CD is an expensive choice.—*BB*

Versa 2435CD. Street price: $3,000. NEC Computer Systems Division, Mountain View, CA; 800-632-4636, 508-264-8000; fax, 800-366-0476; www.nec.com. *Circle 460 on reader service card.*

Sceptre Technologies Inc.

SoundX S4000T

The $2,995 (list) Pentium/133-based SoundX S4000T, from Sceptre Technologies, is aimed at corporate salespeople and mobile presenters. This system was a great performer on our tests, garnering the roundup's highest graphics and processor scores. Full Power Investment manufactures the notebook, which is also offered by both ARM and Dell with slightly different components (also reviewed in this roundup).

The SoundX weighs in at 7.5 pounds (travel weight). Except for having a smaller hard disk (a 776MB Toshiba model) than the ARM unit (a 1.3GB Maxtor) and the Dell system (a 1.3GB IBM), it carries the same features as its Full Power siblings: a 12-inch active-matrix Super VGA display, a lithium ion battery, a modular bay (which holds either a 6X Torisan CD-ROM drive, a floppy disk drive, or a secondary battery), stereo speakers, a PC Card bay that can hold either a Type II or a Type III card, and a 115.2-Kbps infrared port.

SUITABILITY TO TASK	
Sharp PC-9030	
Desktop replacement	Good
Road warrior	Good

The SoundX unit, too, is anchored by a 128-bit NeoMagic MagicGraph128 graphics chip set, a mobile Triton chip set, and 256K of pipelined-burst L2 cache. It also has FM-synthesis sound, built-in speakers, and microphone and speaker jacks.

With these components, the SoundX posted the roundup's highest CPUmark and Graphics WinMark 97 scores. Its Winstone 97 score was also above average, and its Disk WinMark 97 result was average. The unit's CD-ROM WinMark 97 score was below average, however. The system's battery lasted a healthy 2:38 on our BatteryMark test.

Sceptre also includes a Kensington cable for locking the system to your desk. The SoundX does not have the Dell machine's software bundle or the ARM unit's hard disk, but it's still head and shoulders above the remaining competition.—*CM*

SoundX S4000T. List price: $2,995. Sceptre Technologies Inc., City of Industry, CA; 800-788-2878, 818-369-3698; fax, 818-369-3488; www.sceptretech.com. *Circle 461 on reader service card.*

SUITABILITY TO TASK	
Sceptre SoundX S4000T	
Desktop replacement	Good
Road warrior	Good

Sharp Electronics Corp.

Sharp PC-9030

The $2,999 (list) Sharp PC-9030 has a lot to offer, including a Super VGA display that's sharp enough to live up to the company's name, a useful software bundle, and replacement service with 24-hour turnaround. A relatively short battery life was the only performance disappointment. Sharp aims the unit at corporate and small-office/home-office users.

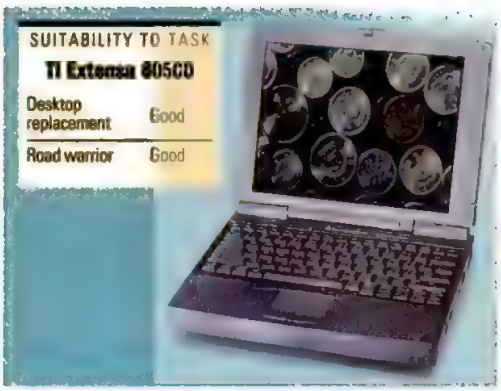
The centerpiece of the 7.9-pound (travel weight) Pentium/120-based PC-9030 is its display. The 11.3-inch active-matrix screen offers Super VGA resolution and Sharp's Super High Aperture Screen Technology. According to Sharp, this feature brightens screen images by 50 percent and lowers power usage by up to 38 percent compared with other TFT screens.

With 256K of L2 cache, a SiS chip set, and EDO memory, the unit proved a good test performer. The 6X CD-ROM drive, operating from the modular bay (which can also fit the standard floppy disk drive), turned in average results. Most other test scores were also average. The PC-9030's lithium ion battery, however, had a below-average BatteryMark timing of 1:38.

The unit features built-in sound, a microphone, and two stereo speakers. A set of I/O ports, a PC Card slot (for one Type III or two Type II devices), and a 115.2-Kbps IrDA port are also present. Sharp ships the machine with small-office software (Photo Editor, Sharp Multimedia Player, several online packages, and infrared file-transfer software) and provides a three-year warranty. If you have major problems, Sharp promises to repair or replace the system within 24 hours.

Given this attention to the end user and the unit's exemplary display, the PC-9030 is set to please, although some users may be turned off by the poor battery life.—*CM*

Sharp PC-9030. List price: $2,999. Sharp Electronics Corp., Mahwah, NJ; 800-237-4277, 201-529-8200; fax, 201-529-9113; www.sharp-usa.com. *Circle 462 on reader service card.*



Texas Instruments Inc.

TI Extensa 605CD

With an extensive software bundle and an integrated CD-ROM drive, the $2,650 (street) TI Extensa 605CD is a bargain worthy of consideration. But because the unit has no secondary cache, it is a rather poor performer. This Pentium/120 machine is marketed as a competitively featured, price-conscious system for mobile executives, SOHO users, and students.

We placed a $2,750 limit on machines without a CD-ROM drive and a $3,000 limit on units with one; even though the Extensa 605CD has a fixed 6X CD-ROM drive, it came in under the first price point. Both the CD-ROM drive and the system's removable 810MB hard disk helped deliver average test scores. These were offset by the unit's lack of an L2 cache, which resulted in very low CPUmark, Graphics WinMark 97, and Winstone 97 scores.

Aside from these weaknesses, the 7.4-pound (travel weight) Extensa 605CD is an admirable machine. It includes a 12.1-inch dual-scan display, two stereo speakers, a PC Card bay, a 115.2-Kbps IR port, several audio jacks, and a full set of standard I/O ports. Though the unit can use an optional $229 lithium ion battery, the tested system had a Duracell nickel hydride pack that produced a respectable 2:18 timing on our BatteryMark test.

The Extensa 605CD comes with an external floppy disk drive, MPEG capability, and a software bundle that includes Lotus Organizer, MS Money, MS Works, and TranXit. This notebook's many pluses make it well worth the price, although users desiring better performance should opt for a unit with L2 cache.—*CM*

SERVICE & RELIABILITY	Texas Instruments
Reliability	Average
Repair	Average
Technical support	Average
Percent needing repair	Worse than average

TI Extensa 605CD. Street price: $2,650. Texas Instruments Inc., Dallas, TX; 800-848-3927, 817-774-5856; fax, 817-774-6660; www.ti.com. *Circle 463 on reader service card.*

Toshiba America Information Systems Inc.

Toshiba Satellite Pro 430CDS

PC MAGAZINE EDITORS' CHOICE

The Toshiba Satellite Pro 430CDS stands out for two reasons: Not only is it one of the few notebooks on the market to have a 10X CD-ROM drive, but it is priced at only $2,500 (street). A good performer, this appealing 120-MHz unit provides lots of bang for the buck, earning

Built by engineers.

HEWLETT PACKARD

SUITABILITY TO TASK	Toshiba Satellite Pro 430CDS
Desktop replacement	Good
Road warrior	Good

it our Editors' Choice in this roundup.

Because of the integrated AC adapter, the system's 7.3-pound travel weight is only a shade heavier than its standalone weight. The unit also features an 11.3-inch dual-scan display, a PC Card bay (for one Type III card or two Type II), a 115.2-Kbps infrared interface, a full set of standard I/O ports, and audio jacks. A pale-green pointing stick rests in the keyboard, while two mouse buttons reside in the middle of the palm rest (one atop the other rather than side by side). The system also has a convenient volume-control thumbwheel and one speaker.

The Satellite Pro's lack of an L2 cache did not hurt it on our tests. It earned average results on most tests, except for its above-average score on the Disk WinMark 97 and CD-ROM WinMark 97 tests. The latter score—the highest in the roundup—was delivered by a Toshiba 10X drive, which fits into the system's modular bay. (A standard floppy disk drive can be used in this bay; you can also operate it externally via a caddy.) The system's battery is a lithium ion model that lasted a healthy 2:22 on our BatteryMark test.

In addition to providing a three-year warranty, Toshiba augments the Satellite Pro with an eclectic software bundle that includes a media player, TranXit utilities, and an MPEG software package. The Satellite Pro is a wonderfully designed unit that should satisfy its target audience well.—*CM*

SERVICE & RELIABILITY	Toshiba
Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Better than average

Toshiba Satellite Pro 430CDS. Street price: $2,500. Toshiba America Information Systems Inc., Irvine, CA; 800-334-3445; computers.toshiba.com. *Circle 464 on reader service card.*

Twinhead Corp.

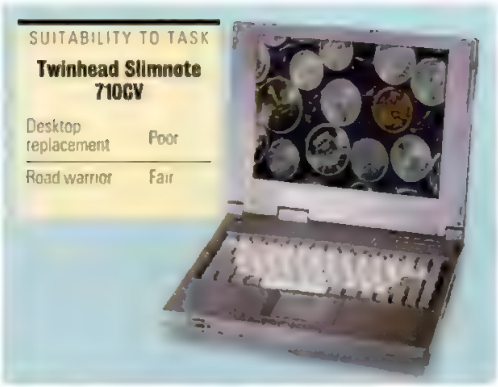
Twinhead Slimnote 710CV

With a 6.2-pound travel weight and a price of just $2,019 (direct), the Twinhead Slimnote 710CV should satisfy its target audience: cost-conscious users who spend more time on the road than in the office. Although this ultra-portable runs at only 100 MHz and lacks an L2 cache, lowering its performance, an infrared port and a modest software bundle enliven it.

The Slimnote was intended not to be a power performer but to be thin, light, and inexpensive. At 1.3 inches thick, 5.6 pounds (system weight), and $2,019, it is the roundup's slimmest, lightest, and least costly unit and has all the basics. Though the keys are small (17-mm), it has an 11.3-

Used by normal people.

HEWLETT PACKARD



inch dual-scan display. The unit also has two stereo speakers, audio jacks in front, a touch pad, a PC Card bay, an integrated floppy disk drive, and a 115.2-Kbps infrared port. Twinhead bundles software for MPEG support, TranXit, and a suite of basic multimedia applications as well. A $549 docking station is also available.

Using a SiS chip set, a 776MB hard disk, and a Cirrus Logic GD7543 graphics chip set, the unit delivered the roundup's lowest test scores. Its nickel hydride battery's life was also poor: just 31 minutes. (The unit had a BIOS problem, which Twinhead expects to fix by the time you read this.)

Those preoccupied with power won't like this unit; those concerned with convenience and budgets probably will.—*CM*

Twinhead Slimnote 710CV. Direct price: $2,019. Twinhead Corp., Milpitas, CA; 800-995-8946, 408-945-0808; fax, 408-945-1080; www.twinhead.com. *Circle 465 on reader service card.*

Wedge Technology Inc.

Showbiz-5000

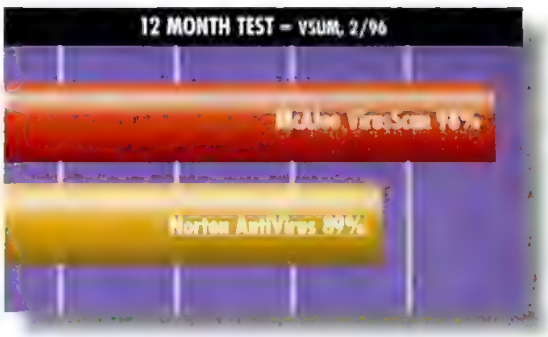
Wedge Technology's $2,600 (street) Showbiz-5000 runs at 100 MHz and is a mediocre performer, but it will get the job done for its intended audience: thrifty first-time buyers in both home and corporate environments.

The Showbiz-5000 has a 7.9-pound travel weight. The unit's chassis contains a touch pad whose buttons are beside it rather than beneath it; two stereo speakers reside on the palm rest. The display is only 10.4 inches but is active-matrix and supports Super VGA resolution.

A modular bay can accommodate a 6X CD-ROM drive, a second battery ($225), a second hard disk ($550), or a standard floppy disk drive. You can also use the latter externally with an accompanying caddy. A port replicator is a $159 option.

With a 1.3GB hard disk, 256K of L2 cache, and a C&T 65548 graphics chip set with 1MB of DRAM, the system did well on our tests compared with the two other 100-MHz units. But its scores were fairly low, no surprise since most units in this

WHO SAYS VIRUSSCAN'S MACRO



VIRUS RESEARCHERS.

Everyone says McAfee VirusScan is the world's most effective anti-virus protection. Independent tests prove it. Editorial reviews confirm it. And 68% market share leaves no doubt.

But for some reason, word hasn't reached our friends at Symantec. In a series of highly misleading ads, they claim Norton AntiVirus is superior virus protection.

Fortunately for you, those claims have been exposed and publicly condemned by everyone from NCSA and *Virus Bulletin* to *Information Week*. The *San Jose Mercury News* referred to the incident as, "Symantec's little fib."

In Symantec's latest ad, they "test" Norton AntiVirus against VirusScan in detecting Word macro viruses. What they don't tell you is that they designed the test, supplied only the viruses that they could detect, and paid for the test themselves. *Secure Computing* calls the results "speculative."

At McAfee, we don't manipulate virus detection tests. We don't have to. As

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roundup have faster CPUs. The unit's hot-swappable lithium ion pack lasted 2:09 on our BatteryMark test.

All things considered, the Showbiz-5000 is a well-rounded machine that can satisfy cost-conscious users.—*CM*

Showbiz-5000. Street price: $2,600. Wedge Technology Inc., Milpitas, CA; 800-872-9334, 408-263-9888; fax, 408-263-9886; www.wedgetech.com. *Circle 466 on reader service card.*

WinBook Corp.

WinBook FX

The variant of the WinBook FX that sells for $2,999 (direct) is merely a starting point for WinBook's high-end line. This 133-MHz system—which receives an honorable mention in this roundup—is an admirable performer with a sharp active-matrix display; it also has this roundup's longest battery life. But in order to meet our price filter, the test unit came without some of the FX line's special features, such as a touch pad that operates currently with a pointing stick.

The WinBook FX weighs 8.4 pounds (travel weight). Its modular bay holds a standard floppy disk drive, an optional second battery ($259), and a 6X CD-ROM drive. The WinBook's lithium ion smart battery had a tested life of 3:52—the best in the roundup.

SERVICE & RELIABILITY	WinBook FX
Reliability	Average
Repair	Average
Technical support	Average
Percent needing repair	Average

The unit also has 256K of pipelined-burst L2 cache and a 776MB hard disk. The 11.3-inch Super VGA TFT display is currently supported by a 32-bit Cirrus Logic graphics chip set with 1MB of DRAM, though 2MB will be standard by the time you read this, as will a 1GB hard disk. Most of the unit's test scores were average, with one highlight: an above-average CD-ROM WinMark 97 result.

The machine has an RJ-11 jack that connects to a 28.8-Kbps internal data/ fax modem (a 33.6-Kbps modem will be standard by the time you read this), a 115.2-Kbps infrared port, a joystick port, the standard set of I/O and audio ports, two stereo speakers, and a microphone-in jack. You can also record via a built-in microphone.

WinBook includes an extensive Q&A help file specific to the FX line, as well as MPEG and PhotoShop software. The WinBook FX is an appealing machine that will ably get the job done.—*CM* □

WinBook FX. Direct price: $2,999. WinBook Corp., Columbus, OH; 800-468-2162; fax, 800-448-0308; www.winbookcorp.com. *Circle 467 on reader service card.*

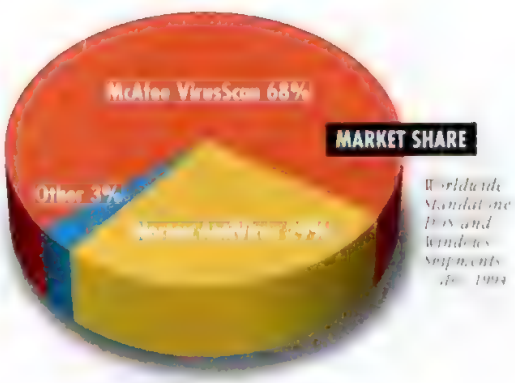
SUITABILITY TO TASK	WinBook FX
Desktop replacement	Good
Road warrior	Good

VIRUS PROTECTION IS THE BEST?

"McAfee beat all other products in macro virus detection." – Secure Computing Magazine

"Symantec's macro virus tests show flaws and may be biased." – NCSA

"The results show the technology is there for McAfee to come up trumps." –Virus Bulletin



INDUSTRY EXPERTS. YOU.

you can see from the *independent* tests above, VirusScan has consistently proven to provide the best protection from not only macro viruses, but viruses of all kinds.

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corporate

z-station GT 166

- 166MHz Intel Pentium® Processor
- 16MB EDO Memory, Expand to 128MB
- 256K Pipelined Burst Cache
- 2.1GB EIDE Mode 4 Hard Drive
- 64-bit Video with 2MB SGRAM
- 12X EIDE CD-ROM Drive
- 15" (13.7" Viewable) .28 Pitch Monitor
- Microsoft® Windows® 95
- Microsoft® Office Professional
- 3 Year Limited Warranty With 1 Year On-site

Same system with 133MHz Intel Pentium® Processor for $1699

$1899

Business Lease for $65/mo

T162E

z-station GT 200m

- 200MHz Intel Pentium® Processor
- 64MB EDO Memory, Expand to 128MB
- 256K Pipelined Burst Cache
- 3.1GB EIDE Mode 4 Hard Drive
- 64-bit Video with 2MB SGRAM
- 12X EIDE CD-ROM Drive
- 17" (15.5" Viewable) .28 Pitch Monitor
- 33.6Kbps Fax/Data Modem
- Ensoniq Vivo 90 Wavetable Soundcard
- Altec Lansing® Speakers
- Microsoft® Windows® 95 or NT
- Microsoft® Office Professional
- 3 Year Limited Warranty With 1 Year On-site

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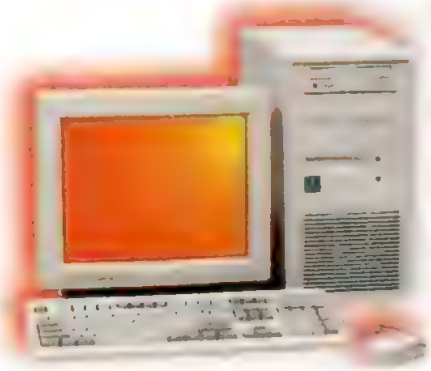
Business Lease for $101/mo

T208GMM



notebooks

z-star gx 100

- 100MHz Intel Pentium® Processor
- 12.1" Active-Matrix with 800x600 Color Display
- 16MB DRAM, Expandable up to 40MB
- 1GB Hard Drive, Upgradable to 1.3GB
- 6X Internal CD-ROM Module
- Lithium Ion Smart Battery
- Infrared IrDA Port
- 256K Synchronous Pipelined Burst Cache
- 128-bit Graphics Accelerator With 1MB Memory
- 16-bit Sound
- Built-in Microphone and Stereo Speakers
- TrackPad Ergonomic Pointing Device
- Microsoft® Windows® 95
- One Year Factory Parts and Labor Warranty
- 6.1 lbs.

Upgrade to 133MHz Intel Pentium® Processor for $150

$2999

Business Lease for $102/mo

G102C

z-star mx 120

- 120MHz Intel Pentium® Processor
- 10.4" Active-Matrix with 800 x 600 Color Display
- 16MB DRAM, Expandable to 40MB
- 1GB Hard Drive
- NiMH battery
- Infrared IrDA Port
- 256k Synchronous Pipelined Burst Cache
- 16-bit Sound
- Built-in Microphone and Stereo Speakers
- TrackPad Ergonomic Pointing Device
- Microsoft® Windows® 95
- One Year Factory Parts and Labor Warranty
- 5.9 lbs.

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N121C

multimedia

check out our complete software bundle listing on the following page

z-station vx 133

- 133MHz Intel Pentium® Processor
- 16MB EDO Memory, Expand to 128MB
- 256K Pipelined Burst Cache
- 2.1GB EIDE Mode 4 Hard Drive
- 64-bit 3D Video with 2MB EDO Memory
- 12X EIDE CD-ROM Drive
- 33.6 Kbps FAX Modem
- Telephone Answering Device & Speakerphone
- 16-bit SRS 3D Wavetable Audio
- Altec Lansing® Speakers
- 15" (13.7" Viewable) .28 Pitch Monitor
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M132E

z-station vx 166

- 166MHz Intel Pentium® Processor
- 32MB EDO Memory, Expand to 128MB
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- 2.5GB EIDE Mode 4 Hard Drive
- 64-bit 3D Video with 2MB EDO Memory
- 12X EIDE CD-ROM Drive
- 33.6 Kbps FAX Modem
- Telephone Answering Device & Speakerphone
- 16-bit SRS 3D Wavetable Audio
- Altec Lansing® Speakers
- 17" (15.5" Viewable) .28 Pitch Monitor
- Microsoft® Windows® 95
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M165F

z-station vx 200

- 200MHz Intel Pentium® Processor
- 32MB EDO Memory, Expand to 128MB
- 256K Pipelined Burst Cache
- 3.1GB EIDE Mode 4 Hard Drive
- 64-bit 3D Video with 2MB EDO Memory
- 12X EIDE CD-ROM Drive
- Iomega Zip 100 Drive
- 33.6 Kbps FAX Modem
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Business Lease for $94/mo R205G

performance pro 200p

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- [illegible]
- 256K Pipelined Burst Cache
- 4GB SCSI Hard D[illegible]
- [illegible]
- 12X SCSI CD-ROM Drive
- 17" (15.5" Viewable) .28 Pitch Monitor
- Microsoft® Windows® NT
- Microsoft® Office Professional
- [illegible]
- 3 Year Limited Warranty With 1 Year On-site

$3749

Business Lease for $128/mo R208J

z-station GT 200c

- [illegible]
- 16MB EDO Memory, Expand to 128MB
- 256K Pipelined Burst Cache
- [illegible]
- 64-bit Video with 2MB EDO
- 8X EIDE CD-ROM Drive
- 15" (13.7" Viewable) .28 Pitch Monitor
- Microsoft® Windows® 95
- 3 Year Limited Warranty With 1 Year On-site

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DVD AND CD-ROMs

21ST CENTURY STORAGE

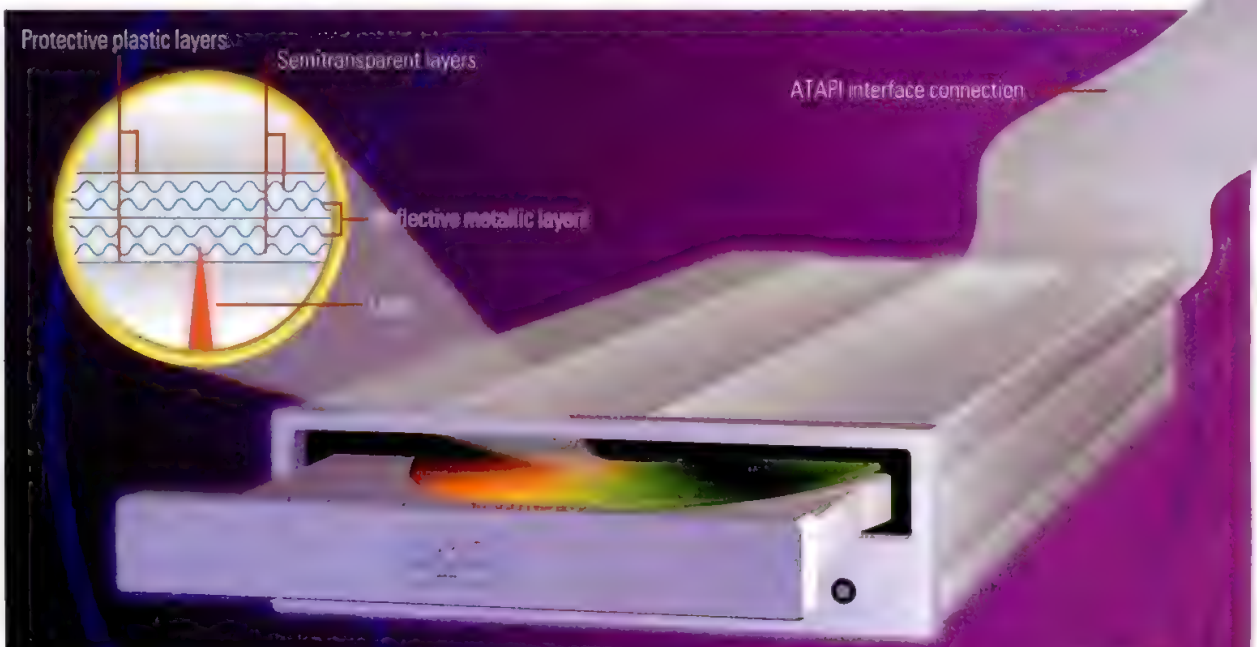
DVD promises to obsolete CDs, laserdisks, and maybe even VHS tape over the coming years. For those with more immediate needs, we test the fastest CD-ROM drives.

The compact optical disk, or CD, has transformed the entertainment and personal computing industries. This spinning silver disk has made it possible to store enormous amounts of music or data on inexpensive, reliably mass-produced media. And it's on its way to becoming obsolete.

In the same way that CDs slowly supplanted vinyl LPs, a new technology, DVD, will steadily replace CD-ROM. DVD—which stood at first for *digital video disk*, then *digital versatile disk*, and now for no term at all—has been under development for a long time. But we're finally on the verge of the paradigm shift.

By Alfred Poor

The three most exciting things about DVD are its capacity, interoperability, and backward compatibility. The first DVD disks hold 4.7GB of data, roughly the equivalent of seven CD-ROM platters. This capacity will be an immediate boon for applications such as map-



THE FIRST GENERATION OF DVD DISKS will use a single layer containing 4.7GB of data. Future iterations will add a semitransparent layer readable by a dual-power laser, boosting capacity to 8.5GB. Eventually double-sided, dual-layer disks could deliver 17GB of information per platter, though you would have to flip the disk over to read the second side.

THE FIRST DVD-ROM DRIVES will be sold [illegible] as kits, with a bare drive and with an add-in card to handle the MPEG-2 video and AC3 audio decompression. Prices will range from $700 to $900. Eventually the decompression functions will move to the motherboard, to the graphics accelerator, or to software, eliminating the need for the extra card and helping to lower prices.

ILLUSTRATION BY JACK HARRIS

ping programs and phone number databases, which now span several CDs. Already, Microsoft's best-selling Encarta spans two CD-ROMs.

DVD will also change the content that developers can deliver. Until now, applications, edutainment titles, and games couldn't offer large amounts of video because it required copious storage space. But a DVD disk can hold over 2 hours of full-motion video (with excellent quality), additional data tracks, and surround-sound audio.

Moreover, the data format and laser technology used for DVD-ROM (DVD–read-only memory) software and PC drives will be the same as for the DVD players and titles sold in the home electronics arena. As a result, movies on DVD disks will play on both your television and your PC.

Finally, manufacturers are making DVD-ROM drives backward-compatible with CD-ROMs. This approach will let you use a DVD drive without losing your investment in CD-ROMs—like having an audio CD deck that played your LPs, too.

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DRIVING FORCES

Computer applications that require massive amounts of data—especially games, with their increasing interactive multimedia content—will push DVD development. As with CDs, though, you can expect the mainstream entertainment industry to be the main force behind DVD's development and its adoption by end users.

Because Hollywood is one of the prime movers behind DVD, home entertainment drives are likely to be the first DVD devices on the store shelves. But Hollywood also did the most to keep DVD from delivery this past fall. The movie industry voiced fears of widespread piracy, since every digital copy of a movie will match the quality of the original. The PC industry contended that schemes to prevent such copying would be unpalatable to most users while providing little protection against determined pirates. Hollywood made its point, and drive makers and content providers have agreed upon an encryption method.

The question isn't whether you will be converting to DVD but when. Shipments of DVD-ROM drives should surpass those of CD-ROM drives by the year 2000, says International Data Corp., and the equipment will eventually become standard on PCs. In the short term, DVD-ROM upgrade kits and DVD-equipped PCs will start appearing this spring, adding about $700 to $900 to the cost of a base system.

There will be few DVD-ROM software titles for a while, but content providers are ramping up. Home DVD players and titles are on a similar (if perhaps more accelerated) timetable. Players by Philips, Sony, and Toshiba may be out by the time you read this, and other industry giants are dreaming of a DVD Christmas. (For more on the consumer DVD players, see the sidebar "Do Try This at Home.")

THE SPECS

The DVD specifications describe four disk configurations, ranging from 4.7GB to 17GB. We are now seeing single-sided, single-layer disks that are much like traditional CD-ROM disks. Data-transfer rates are higher than for most CD-ROM drives. For entertainment applications (such as movies on-disk), the transfer rate is about 600 KBps (kilobytes per second), which is four times as fast as the standard rate for audio CDs and equivalent to the speed of a 4X CD-ROM drive. For data applications, expect rates of 1.3 MBps or more, roughly equivalent to the speed of a 10X CD-ROM drive.

The final disk design is a hybrid, created jointly by two groups that had been working on their own designs for new high-density optical disks. On one side was the SD (Super Density) design by seven companies, led by Toshiba; on the other side was the MMCD (Multimedia CD) design by Philips and Sony. Faced with a repeat of the VHS-versus-Beta videocassette conflict of the early 1980s, the two groups agreed in 1995 to compromise and create a unified DVD specification.

The movie industry's desire for a digital format for feature-length movies largely drove the standard, and a look at Hollywood's requirements will show you the basic specifications for DVD. The typical feature film is no longer than about 135 minutes. With compression, storing full-motion images consumes about 3,500 Kbps (kilobits per second), and providing

DVD Players: Do Try This at Home

Now that gigabytes of information can be stored on a single silvery disk, does that mean the death of movies on videotape? Clearly, some consumer electronics manufacturers are hoping DVD will provide a much-needed boost to a home electronics market already saturated with VCRs. Meanwhile, others are taking a more cautious approach.

DVD players, as they are called in the consumer electronics business, are set-top boxes designed to play back movies recorded on DVD disks. These devices are designed to play back both standard audio CDs and DVD movies (but not computer-oriented DVD-ROM disks). The new DVD players promise to be a tremendous improvement over conventional VHS tapes.

DVD disks offer over twice the resolution of standard tape, delivering sharper picture quality that will not degrade no matter how many times you watch *The Blues Brothers*. Furthermore, each disk can store over 2 hours on a single side, and can let you choose between a film's wide-screen version or the standard squared-off version most of us watch at home today. DVD disks will also enable studios to release movies containing sound tracks in four different languages and subtitles in many more. For the full theater audio effect, DVD players also support Dolby Digital Surround sound, also known as AC-3. AC-3 offers five distinct channels of full-frequency high-fidelity sound, plus a sixth channel for lower bass tones that increases the potency of sound effects such as explosions and gunfire.

The rich benefits of DVD have created a stir among restless consumer electronics companies that have watched VCR sales sag in recent years. Toshiba introduced the first DVD players for the home audience in November 1996 in Japan. The first models arrived in the United States in January, starting with the Toshiba SD-2006 ($599 list). Sony, for one, is thinking of introducing its DVD player this spring, although the company has not committed to a firm debut date. By the end of 1997, all major consumer VCR makers should have DVD players for sale on the shelves.

The major holdup until now has

From CD to DVD: The Evolution of CD Technology

1980
CD-Audio Philips and Sony create standards for optical disk–based digital audio format.

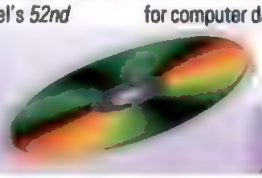
1983
CD Players Sony introduces the first audio CD player, priced at $1,000. The first CD title is Billy Joel's *52nd Street*.

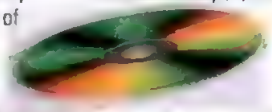
1985
CD-ROM Philips and Sony announce the standard for compact disk–read-only memory for computer data.

1987
CD-ROM Drive The CD-ROM format bows in the PC arena. Drives cost $1,000; the read-only disks hold 650MB of data.

1994
4X CD-ROM Drive Throughput doubles to 600 KBps. Prices for 4X drives are initially $1,000.

1995
6X CD-ROM Drive Throughput rises to 900 KBps, with 6X drives initially costing $600, but these models are about to be usurped by 8X drives.





been the battle over copyright concerns. Digital originals with perfect sound present black marketers the ideal opportunity to bootleg copies, according to Hollywood execs. Conceivably, they said, DVD movies could be copied to hard disks and distributed over the World Wide Web. In response to the threat, consumer electronics companies and Hollywood studios agreed last fall on a copyright protection encryption system. (Similar systems such as MacroVision are already employed in VHS VCRs.)

Regardless of the manufacturers' enthusiasm, a wait-and-see attitude may prevail among consumers. For one thing, rental DVD disks must be widely available to spur the purchase of the DVD players. While DVD disks are cheaper to manufacturer than videotapes, they are also more fragile and more easily scratched, so rental outlets might be apprehensive to offer them at first. And on the retail side, consumer electronics companies are slow to forget their experiences with laserdisks, which never caught on with the general public.

What's more, unlike VCRs, DVD players cannot record your favorite episodes of "General Hospital" or "ER," so most consumers would still want to have VCRs hooked up as well. Before the turn of the century, though, we should see DVD recorders coming to market, which may prove the final nail in tape's coffin.
—*John R. Quain*

: Eventually a DVD recorder will replace the VCR in your home entertainment system, letting you record programs in flawless digital format instead of to videotape.

surround-sound channels eats up an additional 384 Kbps. In order to increase the sales of movies on disk, movie distributors want room for three sound tracks for foreign-language translations. Finally, the movie industry wants up to four tracks for subtitles in additional languages; such tracks need about 10 Kbps. (The storage capacity would also allow for different versions of a movie—for instance, the R-rated version that played in the theaters and a PG version for the kids.)

Add up the requirements for compressed motion video, sound tracks, and subtitle storage and you'll find you need 4,692 kilobits (about half a megabyte) for every second in a 135-minute movie. The total comes to about 4.75GB—which is just what you get with the initial DVD specification.

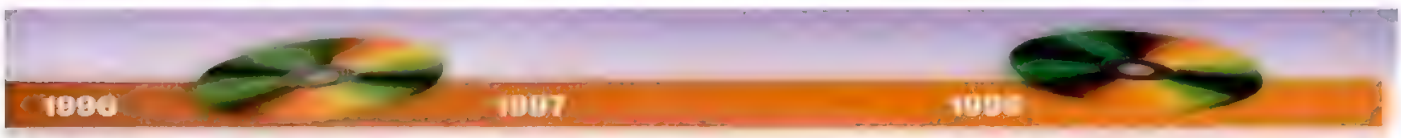
How can you pack this much data onto a CD-size disk? The key is the laser. Because the DVD-ROM drive uses a shorter-wavelength light than the standard CD-ROM drive, it can read smaller data pits on a spiral track whose turns are closer together than on a CD. And the data layer is only half as thick as on a conventional CD, allowing manufacturers to bond two layers onto a double-sided DVD disk of the same thickness as a CD (1.2 mm). This design provides 9.4GB of storage, although you need to turn the disk over to access the data on the other side.

But despite being part of the specification, this so-called "flippy" format is unlikely to see much use right away: Designers have hit upon a way to squeeze even more data onto one side of a DVD. By using a semitransparent gold layer atop the reflective silver-colored layer, the DVD can store two layers of data on one side. Using a lower-power beam, the laser can read the data from the gold layer; then, with an increase of power, it can access and read the silver layer. This method results in slightly less than double the capacity of a single layer, but that is still an impressive 8.5GB per side.

Finally, it is possible to combine two dual-layer platters into a double-sided DVD with a whopping capacity of 17GB—roughly enough for an 8-hour movie.

SQUEEZE PLAY

These estimated runtimes are based on the use of compression to squeeze the data into manageable sizes. This technology deals with two data streams, the pictures and the sound. The video portion is



8X CD-ROM Drive Throughput is up to 1,200 KBps, with the price of an 8X drive initially $400

10X and 12X CD-ROM Drives These drives have a claimed throughput of up to 1,800 KBps. They cost around $250.

CD-R Prices for compact disk–recordable drives drop below $500. This technology lets mainstream PC users create their own 650MB CD-ROMs for data archiving or distribution. The user can write to each blank disk only once.

CD-RW Compact disk–rewritable (also called *compact disk–erasable*) drives and media let users overwrite files on CDs they have created. CD-RW disks are backward-compatible, letting any standard CD-ROM drive read them.

DVD-ROM The paradigm shift to DVD disks begins. These read-only disks hold 4.7GB of data, and the format is standard to both the PC and the consumer electronics markets. The drives can read legacy CD-ROM disks.

High-Capacity DVD-ROM Subsequent iterations of the DVD format increase capacities to 8.5GB for dual-layer designs; to 9.7GB for double-sided, single-layer implementations; and to 17GB for double-sided, dual-layer designs.

DVD-RAM DVD–random access memory drives let users create their own 2.6GB DVDs. The industry will likely skip the write-once format and go straight to designing rewritable disks (à la CD-RW technology).

ILLUSTRATION BY HARRY CAMPBELL

HIGHLIGHTS

Getting Ready for DVD

If you're still reeling from the way CD technology has affected your life—from putting enormous databases at your fingertips to turning your beloved LPs into Frisbees—you might want to sit down. DVD is here.

CD on steroids It looks and feels like a regular CD, but the DVD has a mind-boggling storage capacity: 4.7GB of data can fit on the first generation of disks, the equivalent of seven CD-ROM platters. That's enough space to hold an MPEG-2-encoded 2-hour movie, plus several surround-sound audio tracks. Future iterations could boost DVD capacity as high as 17GB.

Storage magic The key to getting that much data onto a CD-size disk is the laser. Because the DVD makes use of a shorter wavelength of light than the compact disk, it has the ability to read smaller data pits on its spiral track. Also, the spiral turns on a DVD disk are placed closer together.

At home and in the office DVD technology will be used to distribute both computer applications for DVD-ROM drives and movies for home DVD players, eventually making both CD-ROMs and laserdisks obsolete. Users will begin to see richer multimedia content, since games and applications will deliver more full-motion video than was practical with CD-ROMs.

Not dead yet Even though DVD is gamering all of the attention, it will be several years before the transition to this technology is anywhere near complete. In the interim, the new crop of 10X and 12X CD-ROM drives are here and promise to eclipse their 6X and 8X cousins. But beware: Double the spin rate doesn't translate into double the speed. Other factors, such as access time, buffer size, and interface method, are equally critical to drive performance.

fairly straightforward: Because the movie industry wanted images that were at least as good as those of the video laser disk, only high-quality compression would do. That's why the DVD specification calls for MPEG-2 compression (developed by the Motion Pictures Experts Group). Although it is more sophisticated than the MPEG-1 compression used in some computer titles, the fundamental concept is the same: The system identifies which portions of a video segment are unchanged from frame to frame, and it stores only the data describing the differences between frames.

In terms of quality, MPEG-2 (when done well) is a big leap. In demonstrations contrasting DVD with everything from VHS videotape to Hi-8 to laserdisk to the original network-to-affiliate D1 signal, DVD has performed better than all other media except the networks' broadcasts. If you've used a DSS satellite dish, you have MPEG-2 and know how good its pictures can be.

The audio side is a bit more complicated. In the past, stereo sound tracks required only two channels, one for each speaker. Dolby Pro Logic surround sound added a center channel (often used for dialogue) and a monaural surround channel (to fill in the sound from the back) that produced more realistic sound.

DVD supports two systems for encoding sound: Dolby Surround AC-3 (whose name might change to Dolby Digital) and MPEG-2 Audio. Both support more speakers than other methods, but they differ in certain ways. The Dolby AC-3 standard is a *5.1* system; in other words, there are five signal channels plus a nondirectional subwoofer channel. Whereas Dolby Pro Logic uses a matrix approach to encode the center and surround channels, Dolby AC-3 gives each channel its own data stream. It assigns the five channels to the left, center, and right speakers in the front and to the left and right surround speakers in the back, respectively.

MPEG-2 Audio is capable of the same arrangement, but it can also add left-center and right-center speaker channels, for a 7.1 configuration. It is designed to be backward-compatible with stereo and Dolby Pro Logic playback systems as well as with the 5.1 and 7.1 configurations.

It appears that entertainment titles will be using either Dolby AC-3 or MPEG-2 Audio, depending on the part of the world where each title is released. DVDs for the European market will use MPEG-2 Audio, and titles in North America and Japan will use Dolby AC-3. The strongest supporter of this approach is the movie industry. A movie released on DVD in the United States, for example, may still be showing in theaters in Europe; if both locations used the same specifications, there would be no way to prevent copies of the film from finding their way to Europe and cutting into box office revenues.

FROM CD-ROM TO CD-R TO CD-RW

The high-tech path to DVD has been exciting, and it all started with the audio CD. This technology uses a laser beam to read data in a series of pits stamped into a plastic disk. The disk's surface has a reflective silver layer and is protected by a thin, hard coating of lacquer. (That layer carries the printed label.) Unlike a magnetic disk, such as a hard or floppy disk—which has concentric rings (or *cylinders*) divided into sectors—the CD uses one spiral track, as the old vinyl record did.

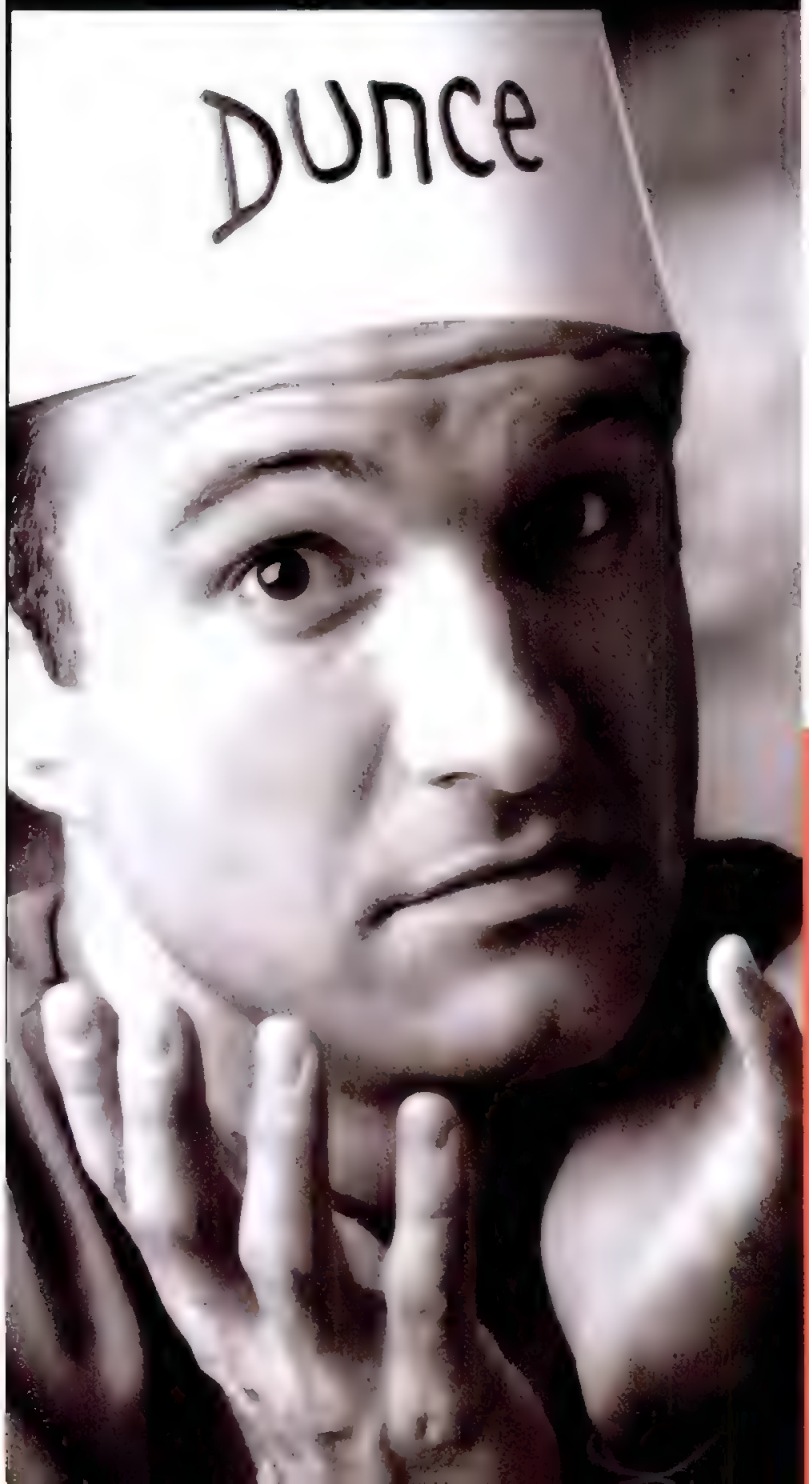
CDs made it possible to store more than 75 minutes of stereo music digitally on one disk, and the technology's potential was not lost on the computer industry. Even when you don't use all of a CD-ROM's storage capacity (sometimes a system may have trouble reading a disk that's nearly full), you can still pack 650MB of computer data onto a standard disk.

The first wave of CD-ROM players to hit the mainstream-PC market were 2X drives, which had data-transfer rates of 300 KBps (double the audio CD rate). You can now purchase 12X drives, and soon you will even be able to buy 16X drives, designed to blast data through at speeds up to 2.4 MBps or more. Not long ago, such speeds were available only with magnetic hard disks. As we note in the accompanying review of today's fastest CD-ROM drives ("Here Today and Tomorrow"), the real-world performance of these drives isn't quite as fast as their rated speed, but it has improved substantially over time.

CD-ROM is a read-only technology;

Our Contributors: ALFRED POOR and JOHN R. QUAIN are contributing editors of *PC Magazine*, and JAMES KARNEY is a frequent contributor. JAMIE M. BSALES was the associate editor in charge of this story, and JEFF MACE was the project leader.

What's your excuse for not having video?



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CIRCLE 248 ON READER SERVICE CARD

naturally, the next step was a technology for writing to the compact disk: CD-R (compact disk–recordable). Instead of containing pits, CD-R disks have a special coating of a temperature-sensitive dye. When the write laser heats a place on this layer, that spot changes color, thereby altering its reflective properties; the read laser of a standard CD-ROM drive can detect this difference. (CD-R disks have a green-gold color, resulting from the layer of thermal dye and the gold reflective layer beneath it.)

The final step in CD evolution was a disk letting users write over their recordings of data. Panasonic's parent company, Matsushita, provided this missing link with its PD (phase-change dual) technology, which uses a laser to change the reflective properties of the disk. Matsushita designed its PD drives to be able to read either PD media (at about 1.1 MBps) or standard CD-ROMs (at 6X).

But the need for compatibility with CD-ROM drives hampered the adoption of PD technology: To read a PD disk to which you had written, you had to use a PD/CD drive. Enter CD-RW (compact disk–rewritable), also called CD-E (compact disk–erasable). This new format marries the phase-change and CD-R technologies, providing full write and rewrite capabilities on disks that any CD-ROM drive can read. CD-RW recorders should start appearing in early 1997.

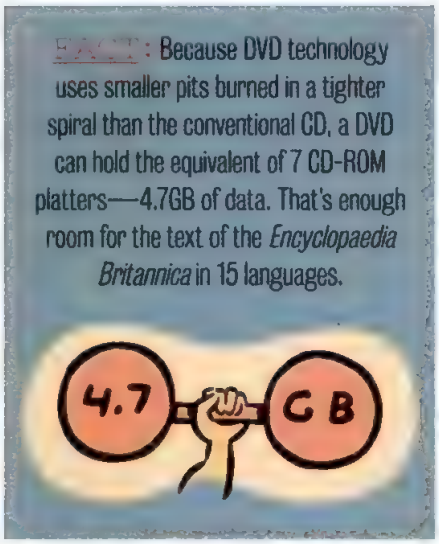
THE ROAD TO COME

We can expect to see DVD mirror the development of CD technology in many ways, though at a much brisker pace. We'll see it fully realize its higher-capacity possibilities (9.4GB, 17GB), and its throughput could also increase.

It seems that we may skip a write-once, DVD-recordable stage and jump directly to a read/write/erase design, analogous to CD-RW. It will be called DVD-RAM (DVD–random access memory). Initial capacity will be 2.6GB, not 4.7GB, because of the difficulty of producing write lasers with small-enough wavelengths.

DVD-RAM may also affect other technologies. Though not likely ever to rival magnetic media for sheer performance, DVD has advantages as to cost, durability, compatibility, and capacity that might pose a serious threat to other optical disk technologies. (These methods include magneto-optical, or MO, technology and proprietary designs such as Pinnacle Micro's Apex, a drive that currently accommodates 2.3GB on each of its two sides. Pinnacle and other major MO manufacturers plan to increase their drives' capacities steadily in the coming years.)

Depending on the cost of media, DVD-RAM could even mount an attack on tape drives as backup devices. Through their use of random access, the disks would be advantageous for archival and near-line storage applications, while providing capacities that only tape has provided until now.



WHAT YOU'LL NEED

DVD-ROM drives will appear early in 1997. In some respects, they will be even simpler than home entertainment DVD players, in that they won't require MPEG-2 decompression hardware. If computer users want to view movies on a DVD drive, they will need to add MPEG-2 decoding to their system via an expansion card. Most manufacturers will bundle such cards, which will also handle Dolby AC-3 support, with DVD-ROM drives; the packages will sell for around $700 to $900. Eventually MPEG-2 functionality will move to the graphics accelerator or the motherboard, and software will handle Dolby AC-3 decoding, lowering the cost of entry. The economics of high-volume production will rapidly drive down prices as well, as was the case with CD-ROM drives.

With the hardware issues falling into place, the biggest problem with DVD and DVD-ROM will be finding disks to use. As usual, there is a bit of a chicken-and-egg problem: Content providers will not create many titles until the installed base of hardware reaches critical mass, but consumers will not buy the hardware until there are enough titles to justify doing so.

But this situation should be easier to resolve than it has been for some earlier technologies. First of all, DVD-ROM drives will be backward-compatible with users' CD-ROM disks. Second, there are plenty of CD-ROM titles that span multiple CD-ROM disks but could be republished on one DVD-ROM disk through a procedure known as *repurposing*. For example, the CD-ROM version of PhoneDisc PowerFinder USA One (one of the first DVD titles to have been announced, in the summer of 1996) requires six disks. But its 3.7GB of data fit on one single-sided, single-layer DVD disk, with room to spare.

The multimedia content of computer games has increased so much that multiple-disk CD-ROM games are commonplace—another prime candidate for repurposing. Digitized photo collections and large reference databases would also be ideal. Encyclopedias would be a good choice, as would an atlas containing every street and address in the United States, which needs up to nine CD-ROM disks.

While a capacity of 4.7GB may seem impossible to fill, keep in mind that early CD-ROMs were often no larger than 100MB, while today's titles commonly reach upwards of 650MB. Software expands to fill the space available.

DVD VISIONS

By now, most of us have learned to avoid superlatives when discussing the capacities of computer components. The great sea of storage capacity in last year's 1.2GB hard disk has seemingly filled up overnight. But it is safe to say that 4.7GB on one disk will radically alter the types and the scope of applications that can be delivered conveniently and economically. The promise of DVD-RAM is alluring. With DVD's CD compatibility and the fact that it will let entertainment titles cross over from home players, we will be able to use this technology well into the next century.

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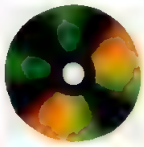
CIRCLE 015 ON READER SERVICE CARD

CD-ROMs

Here Today & Tomorrow

DVD is getting all the attention, but CD-ROM drives aren't dead yet. Here we review the latest high-speed entries.

By James Karney



The sexy new DVD-ROM players will garner a fair share of attention this year, but CD-ROM technology will continue to be the workhorse that helps us get work done and have fun. And although most industry watchers agree that CD is a lame duck, it still has the steam, not to mention the installed base, to be a player into the next decade.

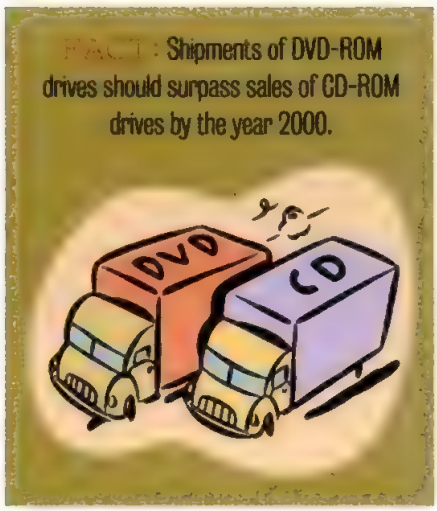
So for this roundup we tested the latest iteration of CD-ROM drives—10X and 12X units—including machines available in the retail, VAR, and OEM channels. We received eight drives from seven vendors: Acer, Diamond Multimedia, Mitsumi, Panasonic, Plextor, Toshiba, and Wearnes. Drives from NEC, Samsung, and TEAC were not ready in time for the roundup, but they should be out the time you read this. Compaq is also showing a 16X drive that may be on the market soon.

THE MEASURE OF SPEED

The CD-ROM market has always been a numbers game, with vendors pushing to develop ever-faster products. Right after 6X drives withered on the vine, 8X machines hit the scene, only to be eclipsed by these 10X and 12X units as the industry darlings. But can a 12X drive really deliver twice the performance of a 6X drive, or is the idea just marketing magic?

A CD-ROM drive's nominal speed is equivalent to its transfer rate. Single-speed drives (1X is the standard for audio CDs) have a transfer rate of 150 KBps (kilobytes per second), whereas the rate for 12X drives is 1.8 MBps (megabytes per second). If raw spindle speed were the only determinant of performance, then a 12X drive would indeed be twice as fast as a 6X. But other factors—such as access time, buffer size, and interface method (IDE or SCSI)—are virtually identical in 6X and 12X drives. As a result, you can expect only a 20 percent boost for most typical CD-ROM applications.

A faster transfer rate will improve performance noticeably when you are loading programs from CD-ROM or transferring large sequential files, but it won't do much for small files and random data reads (for example, in database applications). To perk up operation, your CD-ROM drive will need a better access time and at least a 256K buffer.



Another performance factor is the interface. On our tests, although SCSI drives generally had better average access times than IDE models, this was not true in all cases. But as a rule, the SCSI drives used up less of the CPU's resources, thanks to their bus-mastering host adapters, and therefore performed better on simultaneous tasks. Still, SCSI adds cost, and since most new computers use IDE interfaces, most drives continue to support IDE.

A NEW SPIN

In the coming months, CD-ROM manufacturers are likely to shift from *CLV* (*constant linear velocity*) technology to *CAV* (*constant angular velocity*). On the outer track of a CD-ROM, the laser covers more data in one revolution than on an inner track, which would mean a lack of uniformity in the amount of data read per revolution. CLV rotates the disk at varying speeds, depending on whether the laser is reading from an outer or an inner track, to keep the data rate and the density of the bits being read uniform on all data areas of the surface.

CAV rotates the disk at a constant speed (more like the approach of a hard disk drive). This method is easier on the spindle motor, but it means that the data-transfer rate varies for the outer and inner tracks. Some drive makers may decide to use PCAV (partial CAV) for the inner tracks and CLV for the outer ones. Other vendors might employ CLV for the inner tracks, CAV for the middle zone, and CLV for the outer area.

CAV may improve random access performance, because it does not require the drive to change motor speed as often between random seeks. But before you get too excited about CAV, remember that disks with data only on the inner tracks won't see any boost, and they might even run more slowly. Stay tuned, since the jury is still out on combination CAV/CLV technologies.

If you use a 4X CD-ROM drive, it's probably upgrade time. Note the figures for the 4X Sony CDU-76S that we present for comparison in our performance chart. For example, its average ZD CD-ROM WinMark 97 score was 441 (measured in thousands of bytes per second), and its average access time was 241 ms; the median scores for the 10X and 12X drives were an impressive 990 for CD-ROM WinMark 97 and 140 ms for average access time. Such speed makes loading CD-based software or image files noticeably faster.

There are many factors to consider when shopping for a CD-ROM drive, such as the types of applications you use, special features, and price. The following reviews spotlight eight of the newest high-performance drives; they should provide you with a healthy dose of reality when you flip through those slick brochures.

ILLUSTRATION BY HARRY CAMPBELL

ACER CD612A

A 12X drive, Acer America Corp.'s Acer CD612A is the first PCAV hybrid CD-ROM drive we've seen. According to Acer, its data-transfer rate increases as the laser moves toward the platter's outer edge. This tray-style internal unit ($269 list, $250 street) includes a 128K buffer. The front panel has buttons for audio play/skip/track-advance, eject, volume; an activity LED; and a headphone jack.

Setup was straightforward. We simply opened the case and connected the cables, then let Windows 95 recognize the new hardware. Although this drive offers few frills, it is solidly designed. The rear connectors are well marked and easy to access, and the tray fits snugly into the front bezel.

Our tests showed the CD612A to be a worthy workhorse but not the fastest unit. It came in fourth (behind the Plextor 12Plex PX-12CSi and the Toshiba XM-5701B and XM-5702B), with a CD-ROM WinMark 97 score of 1,035 and a 130-ms average access time. On the plus side, the CD-612A was the best IDE drive in terms of CPU utilization, with a relatively low 65.5 percent. This is a solid product. If its price point and your needs match, it may be a perfect fit. (Acer America Corp., San Jose, CA; 408-432-6200; www.acer.com/aac/. *Circle 474 on reader service card.*)

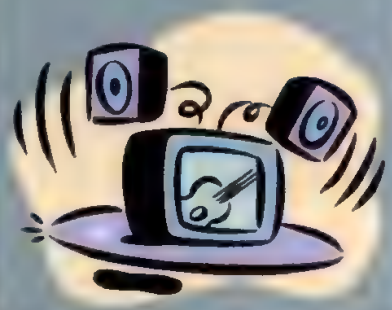
DIAMOND 12X MULTIMEDIA KIT

The Mitsumi FX120 (see next review) is the heart of Diamond Multimedia Systems' Diamond 12X Multimedia Kit ($400 street). This value-added version packs in some sorely needed extras, including a 32-bit Sound Blaster–compatible sound card, a Roland MPU-401 MIDI port, Labtec LCS-1012 Space Saver speakers, cables, and a slew of CD-ROM titles, such as CorelDraw 4.0, Compton's Interactive Encyclopedia, and Myst.

The 12X Kit is a major improvement over Diamond's 8X version, which suffered from imperfect Plug and Play installation. This time around, Windows 95 recognized the new sound board correctly, and we installed the drive without a hitch.

Our performance tests yielded nearly identical results whether we used the sound card's interface or the PC's IDE interface. As with the Mitsumi FX120, performance lagged that of other units in the same class. Still, if you need a complete kit, this bundle is a good value. (Diamond Multimedia Systems Inc., San Jose, CA; 800-468-5846, 408-325-7000; www.diamondmm.com. *Circle 475 on reader service card.*)

FACT: Eventually double-sided, dual-layer DVDs will hold 17GB of data, enough for 8 hours of full-motion video plus surround-sound audio and additional data tracks.



Editors' Choice

• Plextor 12PleX line

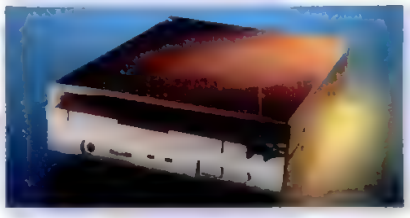
PC MAGAZINE EDITORS' CHOICE

If you're working with a 4X or even a (gasp) 2X CD-ROM drive, consider upgrading to a 10X or 12X. Such drives offer better performance for certain tasks and are surprisingly affordable. Of the eight high-speed drives we examine in this roundup, the Plextor 12PleX wins Editors' Choice. At $330 (street), the caddyless 12PleX PX-TS is the most expensive drive we tested (the version with a caddy, the 12PleX PX-12CSi, costs $380), but it is also the best.

Performance was tops, and Plextor includes a quality Adaptec SCSI host adapter as well as a two-year warranty. Given Plextor's track record of quality and reliability over the long haul, the 12PleX is the drive we would put in our machine.

The roundup's most intriguing product is the Panasonic 10X Big 5 ($250 street), which merits honorable mention. This 10X IDE drive couldn't keep pace with the 12X models, but it has the advantage of convenience. A five-disk changer, it fits in a standard 5.25-inch drive bay and lets you keep five platters at the ready. It's a boon for users who swap among titles often or who use database or mapping applications that span several CDs.

Honorable mention also goes to the Toshiba XM-5701B, a SCSI drive ($175 street), and to the Toshiba XM-5702B, an IDE unit ($150 street). These no-nonsense 12X machines deliver excellent performance at a compelling price.



MITSUMI FX120

The Mitsumi FX120 ($249 list, $200 street) is aimed squarely at the VAR and OEM markets, though you will find this 12X drive under the Mitsumi name in retail stores. The package includes the drive, manual, driver, and setup disks; IDE and sound card cables; and two CD-ROMs: a games demo and Microsoft Internet Explorer 3.0. The front panel has a minimalist design: headphone jack, volume control, LED busy light, and eject button. Mounting the drive either vertically or horizontally was easy, and we had no problem installing it under Windows 95.

In terms of performance, the FX120 has less to brag about. The unit's CD-ROM WinMark 97 score of 953 was the poorest of the 12X drives, and it trailed even the 10X drives with its 150-ms average access time. The FX120 also taxed the CPU the most heavily, with utilization reaching over 80 percent. Other drives offer better performance for less money; if you can find it deeply discounted, it might deserve a second look. (Mitsumi Electronics Corp., Irving, TX; 800-648-7864, 214-550-7300; www.mitsumi.com. *Circle 476 on reader service card.*)

PANASONIC 10X BIG 5

If you find yourself swapping between the disks of a large phone number or map database, a CD-ROM changer might be a good solution until DVD-ROM disks become commonplace. It would also be handy for leaving the CD-

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PERFORMANCE TESTS

CD-ROM Drives

High-speed 10X and 12X drives deliver greater data-transfer rates and improved seek times compared with 6X units. But an inadequate buffer size (128K) and unoptimized positioning algorithms might spoil the effect.

What the Numbers Mean

The two measures of a CD-ROM drive's performance are data-transfer rate and access time. Among 12X drives, the Plextor 12PleX PX-12CSi and the Toshiba XM-5701B and XM-5702B emerged as the top performers on the ZD CD-ROM WinMark 97 tests. The Acer CD612A's 128K buffer caused it to lag behind the Toshiba and Plextor drives. Also, its showing on the CD-ROM Sequential 16K Read tests (1,370 KBps) put it more on the level of a 9X than a 12X drive. The Mitsumi FX120 posted the slowest time on the Average Access Time tests, falling 28 ms behind the leader.

The two 10X drives performed as we expected: about 1,500 KBps on our Sequential Read tests, with almost identical access times. But the Wearnes CDD-1020 spun slightly faster than the Panasonic 10X Big 5, so that it had the edge in the CD-ROM WinMark tests.

On our CD-ROM CPU Utilization tests, the IDE drives taxed more than 50 percent of the Pentium's processing power, whereas the SCSI drives used only about 11 percent. The difference was evident when we ran the machines through our Indeo Video Playback tests: SCSI drives left the CPU greater freedom to process concurrent tasks without dropping any frames. By contrast, the IDE drives ate up the CPU's resources while attempting to decompress incoming video; as a result, they dropped some frames.

How We Tested

The **ZD CD-ROM WinMark 97** test suite assesses CD-ROM data-read operations based on profiles of six popular Microsoft Windows CD-ROM applications.

The **CD-ROM Sequential 16K Read** tests measure a drive's sequential data throughput rate. Each drive reads a large portion of our test CD in 16K blocks.

The **Average Access Time** tests assess a drive as it positions the read head over random data sectors and reads 2K blocks there.

The **CD-ROM CPU Utilization** tests measure the proportion of total CPU time used for retrieving data from the CD-ROM subsystem.

The **Indeo Video Playback** tests measure performance using a 450-frame, 320-by-240, 30-frame-per-second, 600-KBps compressed .AVI file.—*Analysis written by Denis Tom*

Bold type denotes first place within each category.	ZD CD-ROM WinMark 97 Thousands of Bps	Average Access Time Milliseconds	CD-ROM Sequential 16K Read Thousands of Bps	CD-ROM CPU Utilization Percent	Indeo Video Playback† Frames dropped
12X DRIVES					
Acer CD612A (IDE)	**1,035**	130	1,370	65.5	3
Diamond 12X Multimedia Kit (IDE)	991	141	1,820	78.5	5
Mitsumi FX120 (IDE)	953	150	1,830	80.4	3
Plextor 12PleX PX-12CSi (SCSI)	**1,075**	**122**	1,815	**10.7**	**0**
Toshiba XM-5701B (SCSI)	1,070	133	**1,835**	10.8	**0**
Toshiba XM-5702B (IDE)	**1,075**	135	1,810	80.0	5
10X DRIVES					
Panasonic 10X Big 5 (IDE)	852	145	1,500	71.5	7
Wearnes CDD-1020 (IDE)	908	144	**1,540**	67.7	4
4X DRIVE					
Sony CDU-76S (SCSI)*	441	241	612	3.7	9
	BETTER ►	◄ BETTER	BETTER ►	◄ BETTER	◄ BETTER

* Reported for comparison.
† With a 320-by-240, 30-fps, 600-KBps video clip.

ROMs that you most frequently use loaded and ready to go. This functionality makes the Panasonic 10X Big 5 ($299 list, $250 street) the roundup's most intriguing product. The 10X IDE drive is a five-disk changer that fits into a standard 5.25-inch drive bay. Though not the speediest drive we tested, it offers solid performance and features plus a generous two-year warranty.

A series of trays hold the disks in a custom cartridge, which you control via buttons on the front panel or through Panasonic's Disc Director. This software lets you assign each tray a drive letter or group all of them in a single drive volume. Installing the drive was quick and easy, and the manual is unusually comprehensive.

As expected, the Big 5's multitray design and 10X speed caused it to fare poorly in our time trials. It produced the slowest CD-ROM WinMark 97 score (852), a 145-ms average access time, and a CPU utilization score of 71.5 percent.

But performance is not this product's selling point. We found it a very capable personal jukebox, and it would make a worthy addition to any system you use for serious CD-ROM data storage. (Panasonic Computer Peripheral Co., Seacaucus, NJ; 800-742-8086, 201-348-7000; www.panasonic.com. *Circle 477 on reader service card.*)

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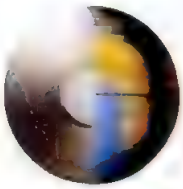

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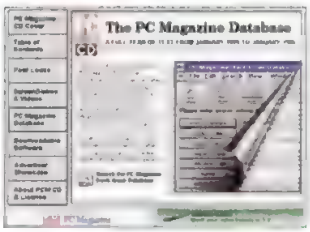

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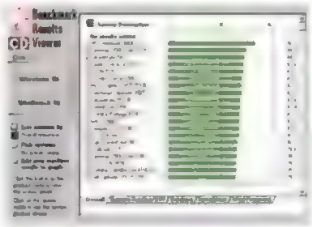

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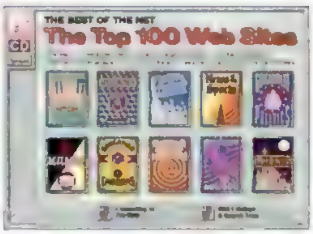

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SUMMARY OF FEATURES

CD-ROM Drives

■ YES ■ NO
Products listed in alphabetical order

	Acer America Corp. **Acer CD612A**	Diamond Multimedia Systems Inc. **Diamond 12X Multimedia Kit**	Mitsumi Electronics Corp. **Mitsumi FX120**	Panasonic Computer Peripheral Co. **Panasonic 10X Big 5**	PC MAGAZINE Editors' Choice Plextor Corp. **Plextor 12PleX PX-12CSi**	Toshiba America Information Systems Inc. **Toshiba XM-5701B**	Toshiba America Information Systems Inc. **Toshiba XM-5702B**	Wearnes Peripherals International (Pte.) Ltd. **Wearnes CDD-1020**
List/street price of internal version	$269, $250	N/A, $400	$249, $200	$299, $250	$349, $330 (caddy, $50)	$195, $180	$165, $150	N/A, $130
List/street price of external version	N/A	N/A	N/A	N/A	$439, $420 (caddy, $60)	$295, $270	N/A	N/A
Interface type	IDE	IDE	IDE	IDE	SCSI	SCSI	IDE	IDE
Mechanical Specifics								
Rated speed	12X	12X	12X	10X	12X	12X	12X	10X
Mechanism manufacturer	Acer Peripheral	Mitsumi	Mitsumi	Matsushita	Plextor	Toshiba	Toshiba	Philips
Controller manufacturer	N/A	N/A	N/A	N/A	Adaptec/ AdvanSys	N/A	N/A	N/A
Available with/without caddy	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Buttons for next track/previous track	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Headphone jack	■	■	■	■	■	■	■	■
Volume knob	■	■	■	■	■	■	■	■
Manual eject and software eject	■	■	■	■	■	■	■	■
Drive can be used on its side	■	■	■	■	■	■	■	■
RCA jacks/Red Book audio connector:								
Internal version	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
External version	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Drawer can be locked to prevent theft of media	■	■	■	■	■	■	■	■
Supports CD-ROM XA	■	■	■	■	■	■	■	■
Supports CD-Plus	■	■	■	■	■	■	■	■
Supports CD-Interactive	■	■	■	■	■	■	■	■
Supports Photo CD	■	■	■	■	■	■	■	■
Performance Ratings								
Buffer size	128K	256K	256K	128K	512K	256K	256K	256K
Average access time	135 ms	130 ms	130 ms	130 ms	105 ms	125 ms	125 ms	130 ms
Data-transfer rate	1.8 MBps	1.8 MBps	1.8 MBps	1.5 MBps	1.8 MBps	1.8 MBps	1.8 MBps	1.5 MBps
Software and Customer Support								
Plug and Play for Windows 95/NT	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Works under OS/2	■	■	■	■	■	■	■	■
Toll-free technical support	■	■	■	■	■	■	■	■
Technical-support hours (eastern time)	9:00 A.M.–10:00 P.M. M–F	8:00 A.M.–10:00 P.M. M–F, 11:00–7:00 Sat.	8:00–7:00 M–F	24 hours, 7days	9:30–8:30 M–F	11:00–8:00 M–F	11:00–8:00 M–F	11:00–11:00 M–F
Warranty (parts and labor)	1 year	1 year	1 year	2 years	2 years	1 year	1 year	1 year
Web address	*www.acer.com/aac/*	*www.diamondmm.com*	*www.mitsumi.com*	*www.panasonic.com*	*www.plextor.com*	*www.tais.com/taisdpd/*	*www.tais.com/taisdpd/*	None

N/A—Not applicable: The product does not have this feature.

PLEXTOR 12PLEX LINE

There's nothing cheap about the Plextor 12PleX PX-12CSi, either in its design or its price. This SCSI-based unit sets the standard for high-performance CD-ROM drives and delivers all the amenities: a 512K buffer, a custom Adaptec AHA-2930 host adapter, control software (Plextor Manager), and a two-year warranty—all with a price tag to match. The internal caddyless version, the Plextor 12PleX PX-12TS, has a $349 list price and a $330 street price, while the internal version with caddy, the PX-12CSi, lists for $399 and has a $380 street price. (Plextor is one of the last holdouts still offering a caddy design.)

The front panel hosts a recessed headphone jack, a wheel for audio volume, LEDs indicating drive activity and power, and eject and audio play/track-advance buttons.

Installing the PX-12CSi was effortless using either our AHA-2940 host adapter or the adapter shipped with the product. With ours, the machine led the pack on our tests: It tied with the Toshiba XM-5702B for the best CD-ROM WinMark 97 score (1,075) and boasted the fastest average access time, 122 ms. But its CPU utilization, just 10.7 percent, was the lowest of the group.

This is no bargain basement drive. If quality, reliability, and performance are your main concerns, the Plextor 12PleX PX-12CSi should be at the top of your list. (Plextor Corp., Santa Clara, CA; 800-475-3986, 408-980-1838; www.plextor.com. *Circle 478 on reader service card.*)

TOSHIBA XM-5701B, XM-5702B

"Lean and mean" best describes the SCSI Toshiba XM-5701B ($195 list, $180 street) and the IDE Toshiba XM-5702B ($165 list, $150 street). Definite performance contenders, these 12X drives are nearly identical in physical design, save for their interfaces. The tray-style machines have generous 256K buffers but few other amenities. The front panel controls are limited to an eject button, headphone jack, and volume knob; the back panel lacks labels for jumpers.

What these drives lack in extras, they make up for in performance. Both were at the head of the pack on our CD-ROM WinMark 97 tests, with the XM-5702B's score of 1,075 tying it for first with the Plextor 12PleX PX-12CSi. Average access times were also respectable. CPU utilization was excellent for the SCSI-based XM-5701B, at 10.8 percent, but the IDE version ran much higher, at 79.9 percent.

With these drives, Toshiba is giving Plextor a real run for the money. Given their low price and their high performance, they belong on your short list of candidates. (Toshiba America Information Systems Inc., Irvine, CA; 800-334-3445, 714-457-0777; www.toshiba.com \taisdpd\. *Circle 479 on reader service card.*)

FACT: DVD-RAM drives will let you record your own optical disks, each of which will hold 2.6GB of data. You could archive all 15 years of *PC Magazine* and still fit 3 years of *The New York Times*, plus *War and Peace* and the Bible.

WEARNES CDD-1020

The second 10X in our lineup is the Wearnes CDD-1020 ($130 street). Like the Mitsumi, this tray-style IDE drive is targeted at the OEM market but is also being sold directly in retail outlets to some extent. It includes a 256K buffer, a sound card cable, a setup disk, and a manual. The front panel has an LED busy light, a headphone jack, a volume control, and play/track-advance and eject buttons.

Setting up the drive under Windows 95 was easy. The CDD-1020's performance scores—908 on CD-ROM WinMark 97 and an average access time of 144 ms—were good for a 10X unit. Wearnes bills this drive as a multitasking machine with excellent CPU utilization; its score of 67.7 percent, which is relatively low for this group, bears out this claim. Although the CDD-1020 isn't as fast as the 12Xers, it may be an alternative for bargain hunters if its street price and its throughput meet their needs. (Wearnes Peripherals International Ltd., San Jose, CA; 408-432-1888. *Circle 480 on reader service card.*) □

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PC Tech

THE DEFINITIVE GUIDE TO PC TECHNOLOGIES & TOOLS

News Servers

A new generation of NNTP servers provides a vehicle for enhanced collaboration.

ILLUSTRATION BY NICK GEBLUCK

By Amarendra Singh

Sharing information and opinions with far-flung associates has generally been handled using proprietary mail solutions, which, though workable, suffer from some severe limitations: Not only does the same (and often expensive) software have to be present on each participant's machine, each message must travel across the network separately for each reader. Moreover, your reach extends only as far as your network does.

With the surge in popularity of the Internet, standards-based servers for such protocols as POP3/SMTP and the upcoming IMAP servers have begun to offer alternatives that do not require expensive and cumbersome clients. As they stand right now, however, the mail protocols do not lend themselves to threaded or group discussions in any significant manner, and the client and network load

IN THIS SECTION

TUTOR The days of easily transferring files between PCs using floppy disks are past, but the good news is that you don't need to invest in a network or a portable hard disk in order to move your files. Jeff Prosise explains three handy and inexpensive techniques for moving large files between PCs. *Page 193.*

POWER PROGRAMMING Last time, we showed you how to build a COM object using Borland's Delphi environment. The second part of our discussion focuses on building four Windows 95 shell extension COM objects in Delphi. *Page 195.*

OPERATING SYSTEMS OS/2's multimedia implementation has long been known for its power—and its slowness. Finally, a new technology may provide a solution: DART (Direct Audio RouTines). In this issue, we determine whether DART really fixes OS/2's multimedia performance woes. *Page 199.*

INTERNET TOOLS Intercast, a new technology developed by Intel, takes advantage of a property of cathode-ray tubes—the same kind found in televisions—to bring together TV and the World Wide Web. We tell you how Intercast works, discuss its potential, and briefly explain how you can get started using it. *Page 203.*

UTILITIES This issue's utility, RUPL2, takes a good thing and makes it even better. In this updated version of the RUPL, users get what they've been asking for: They can now move the utility's recently used programs list from the Programs menu to the Start menu. *Page 207.*

PC TECH ONLINE All of the files mentioned in the PC Tech section are available online from our Web site, at *www.pcmag.com.* Go to the bottom of any page and choose **Download** from the navigation bar. Then choose either *PC Magazine* Utilities or PC Tech Archives, where you can download .ZIP archive files containing all PC Tech files.
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involved in the distribution of each piece of data to multiple locations remains highly inefficient.

LEARNING FROM THE PAST

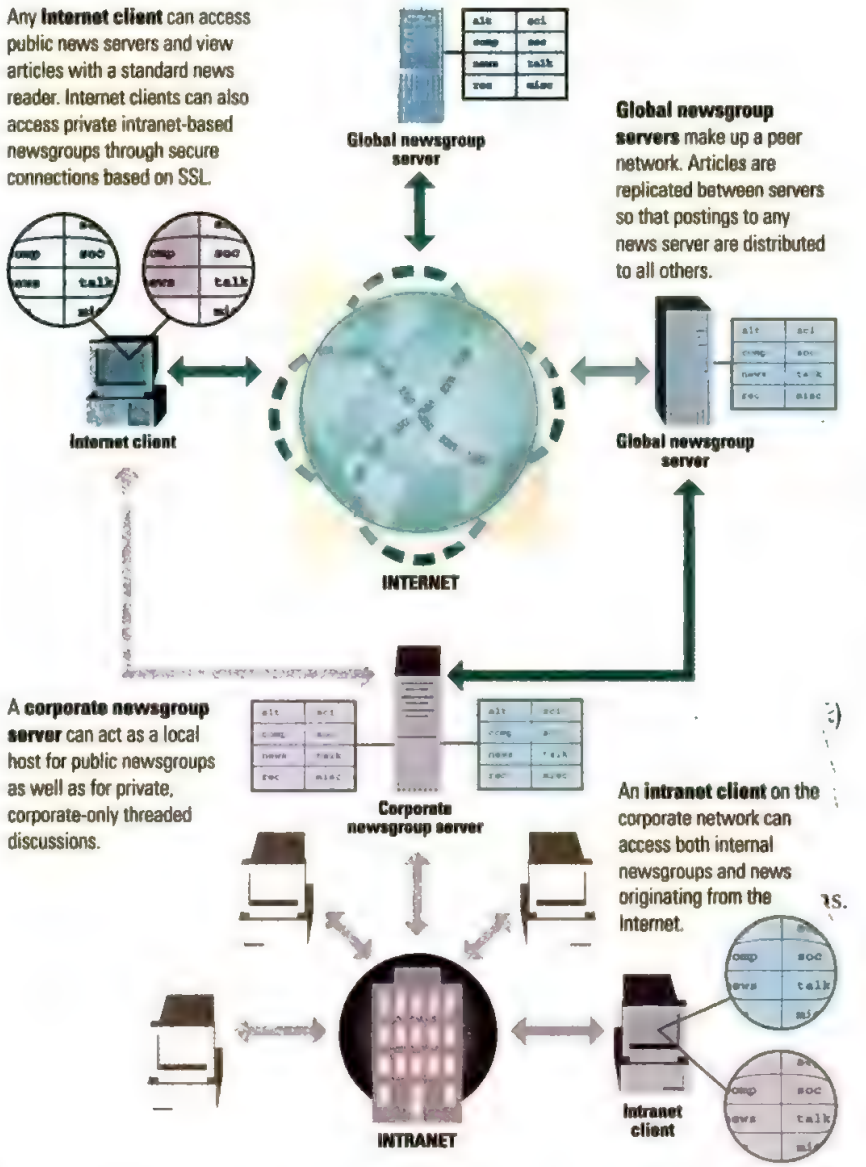
A potential solution has actually existed for some time: The distributed bulletin board system known as Usenet provides a topical hierarchy of threaded discussion groups, using the Network News Transfer Protocol (NNTP), which permits the dissemination of news articles (messages) via TCP/IP—that is, the Internet—in a convenient, cheaper, and more efficient system. Usenet relies on public-domain NNTP server software to host its newsgroups, but new products are emerging that take advantage of and extend NNTP's functionality.

For this review, we looked at Microsoft Internet News Server, Beta 1.0, and Netscape News Server 2.01. Each of the products uses standard NNTP to exchange messages with other news servers. News clients can read and post messages to newsgroups that reside on the news server. To test the products, we set up a server, created a pull feed from our service provider's news server, and created a number of internal discussion groups, both moderated and open. We also gauged how intuitive setup and configuration were and assessed the ease and flexibility of administration.

Usenet got its start back in 1979, with just a few sites exchanging messages over phone links, using software known as UUCP (Unix-to-Unix Copy Program) that allowed the transmission of information over the public telephone network. All news articles had to be downloaded to a user's system. NNTP fueled Usenet's transformation from a few local news groups into a system of hundreds of discussion groups. With an NNTP server, the message store resides in a single location, and you can easily create threaded discussions by topic, using the messaging protocol provided. The workstations don't even need to have Usenet news software installed—reading and posting can be done via TCP/IP messages to a server host running the Usenet software. In addition, the load impact of NNTP on a network is much lower than that of UUCP, an added benefit for sites with many workstations.

NNTP is designed so that news articles are stored in a central database, allowing subscribers to select only those items they wish to read. Indexing and cross-referencing are also provided, plus expiration dates for aged messages. Typically, the NNTP server runs as a background process on one host and accepts connections from other hosts on the LAN. NNTP has commands that provide a straightforward method of exchanging articles between cooperating hosts. Using NNTP, hosts exchanging news articles have an interactive mechanism for deciding which articles are to be transmitted. A host desiring new news or with new news to send will typically contact one or more of its neighbors using NNTP.

News Servers Inside and Out



First, the host will inquire if any new newsgroups have been created on the serving host by means of the NEWGROUPS command. If so, and if deemed appropriate or desired according to local, site-dependent rules, those new newsgroups can be created.

NEW POSSIBILITIES

Usenet newsgroups have become popular because they provide a forum in which individuals can share information and opinions with others with similar interests. It hasn't taken long for corporations to grasp the possibilities for adapting the technology for customer-support sites and for internal workgroup collaboration. It hasn't taken software vendors long either. Interestingly, intranets—private, internal networks that utilize the same protocols as the public Internet—are seen to be sites of huge potential revenues, particularly in the areas of workgroup and collaborative software. NNTP is seen by many to be a viable alternative to existing solutions such as Lotus Notes. The market is open, and fighting for Web dominance in the news server market are the same combatants clashing in the browser and Web server wars: Microsoft and Netscape. Unseating Notes would be an enormous coup—something that hasn't escaped the attention of either vendor.

The discussion groups that corporations are interested in hosting have extra requirements that haven't necessarily been critical in NNTP software before. Commercial-grade news

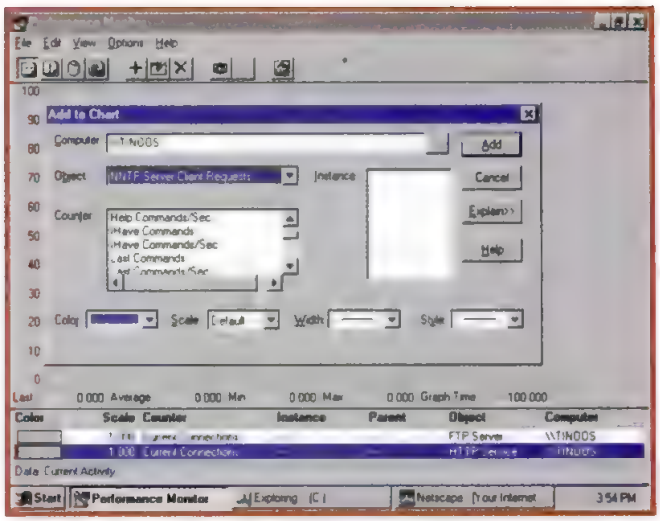
servers need to be stable enough to host mission-critical applications, scalable so that businesses can adapt to growing needs, and secure so that workgroups within an organization can hold threaded discussions without fear of unauthorized access. The products we look at are designed to meet these qualifications. Both perform well; the one you ultimately choose will depend on the platform to which you're committed, your needs, and your resources.

Microsoft Corp.

Microsoft Internet News Server, Beta 1.0

Microsoft's Internet News Server is part of the Normandy family of Internet servers but is also offered as a standalone server. Internet News Server requires the Internet Information Server (IIS), Version 2.0, but since it runs under only Microsoft Windows NT 4.0, which includes IIS, the software is readily available. You may encounter conflicts, however, if you already have a different Web server set up on your system. This aside, setting up the server is quite easy. Once installed, the software can be accessed through the IIS control panel and is set up to run by default. You can change this by accessing the services option in the Windows NT control panel.

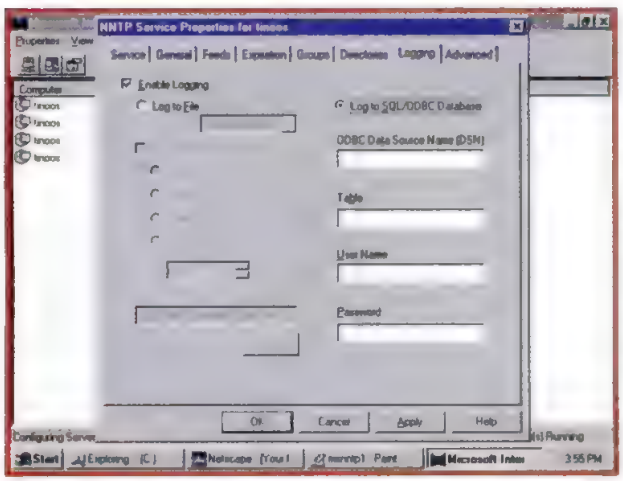
Internet News Server's tight integration with Windows NT, IIS, and other Normandy products significantly enhances the product. You use the Internet Service Manager (the IIS administration tool) to control NNTP configuration. The control panel uses a standard Windows tabbed control-panel interface and allows you to set up various options, which are broken down into eight separate groups. The tool also provides Internet News Server with significant logging capabilities, allowing you to create standard log files that collect usage statistics and track messages and transactions. You can also log on directly to a SQL or ODBC database, which gives you the ability to analyze log information easily using your favorite data-analysis tool. And the Windows NT Performance Monitor allows you to monitor server activity, such as the number and type of users connected, as well as network and user activity. (One caveat: While you can limit the network resource utilization for the NNTP server, for some reason, this setting impacts all aspects of the Internet Service Manager, so you would be limiting network access for your Web, FTP, and other servers as well.)



Integration with the Windows NT Performance Monitor allows you to monitor server activity, such as the number and types of users connected, as well as network and user activity.

Internet News Server also utilizes Windows NT Server access control lists (ACLs) for creating and modifying permissions for individual discussion groups. Administrators can create and modify public, read-only, moderated, and private (authenticated) discussion groups.

Internet News Server supports standard NNTP clear-text password security as well as Secure Sockets Layer (SSL) data-channel encryption. User control can be set up to allow for anonymous, password-based, or Windows NT challenge/response–based password authentication, where the user name and password are encrypted over the network for security; you can also set up the maximum number of connections allowed. Internet News Server allows you to control the size of posts both by individuals and by users. And you can set the maximum posting size for a transfer session between servers as well as the maximum size for each post.



Microsoft Internet News Server utilizes the Internet Service Manager administration tool that is included with IIS 2.0. This gives administrators the ability to create logs that enable them to collect usage statistics and track messages and transactions.

There are three ways to set up the flow of posted messages between servers: The server can be configured to accept a stream being sent from a secondary server, pull a posting from a secondary server, and push a posting to a different server. In each case, you can schedule the timings for these events, allowing you to cause these relatively high-bandwidth transactions to occur either late in the evening or at another low traffic time. Expiration policies can be set for either individual newsgroups or groups of newsgroups. You can set messages to expire when a newsgroup exceeds a certain size, after a specific period of time, or in both instances. For existing Internet newsgroups, the creation of groups will occur when you take your first feed. You can also create your own newsgroups one at a time (although this dialog is extremely cumbersome if you are creating a significant number of groups for your intranet).

Microsoft Internet News Server is compatible with other NNTP clients and servers, which allows for the replication of newsgroups and enables the server to receive news feeds (such as those from Usenet) from other servers. It also supports popular content formats, such as MIME, HTML, .GIF, and JPEG. We found this product to be very easy to set up, configure, and administer. Its integration with other Microsoft products and its ability to have moderated and secure sessions make this an extremely competitive package. Windows NT shops should certainly consider it. **Microsoft Internet News Server Beta 1.0.** List price: Not yet available. Microsoft Corp., Redmond, WA; 800-426-9400; fax, 206-936-7329; www.microsoft.com. *Circle 472 on reader service card.*

Netscape Communications Corp.

Netscape News Server 2.01

Ever since Netscape produced its first generation of Internet servers, it has included a news server; the current version, 2.01, is available for Microsoft Windows NT for Alpha and Intel as well as for the Digital, Hewlett-Packard, IBM, SGI, and Sun Unix

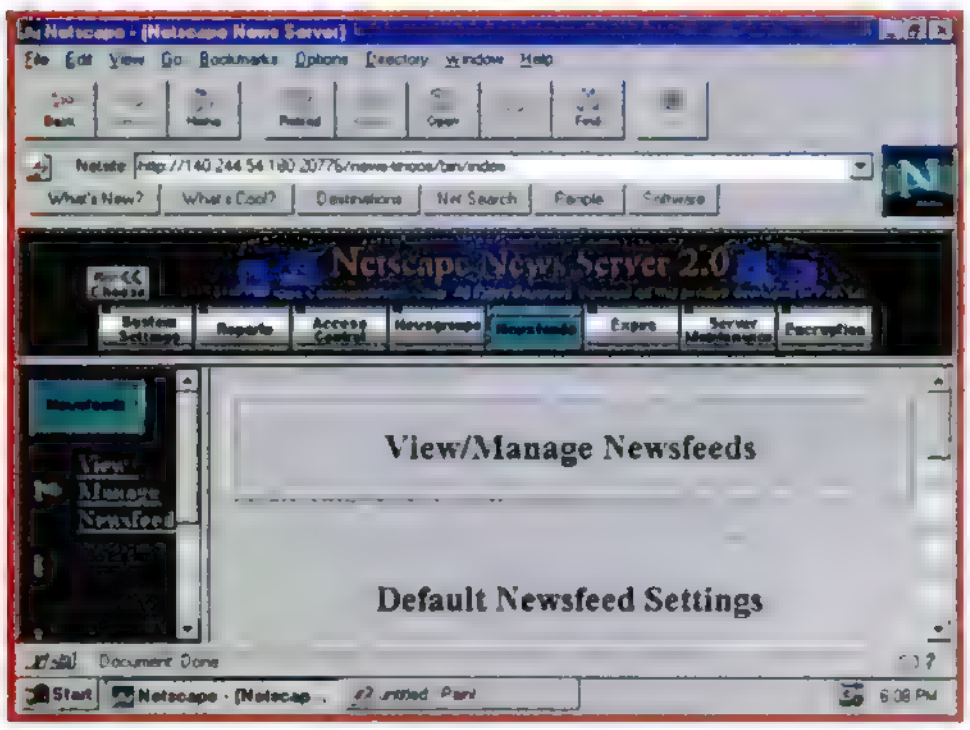
derivatives. This product depth gives Netscape News Server far wider penetration than any other NNTP solution.

For this review, we looked at the version for Microsoft Windows NT. The $995 News Server is integrated with Netscape SuiteSpot Internet servers and includes Netscape's Administration Server, which is required to administer all Netscape servers. After installation, Netscape News Server sets itself up to launch automatically at boot time; you can disable automatic start-up through the Windows NT control panel. Launching the Administration Server lets you manage one or more servers through a simple HTML interface.

Netscape News Server is more powerful and flexible than Microsoft News Server, but it is also a more complex product to configure and administer.

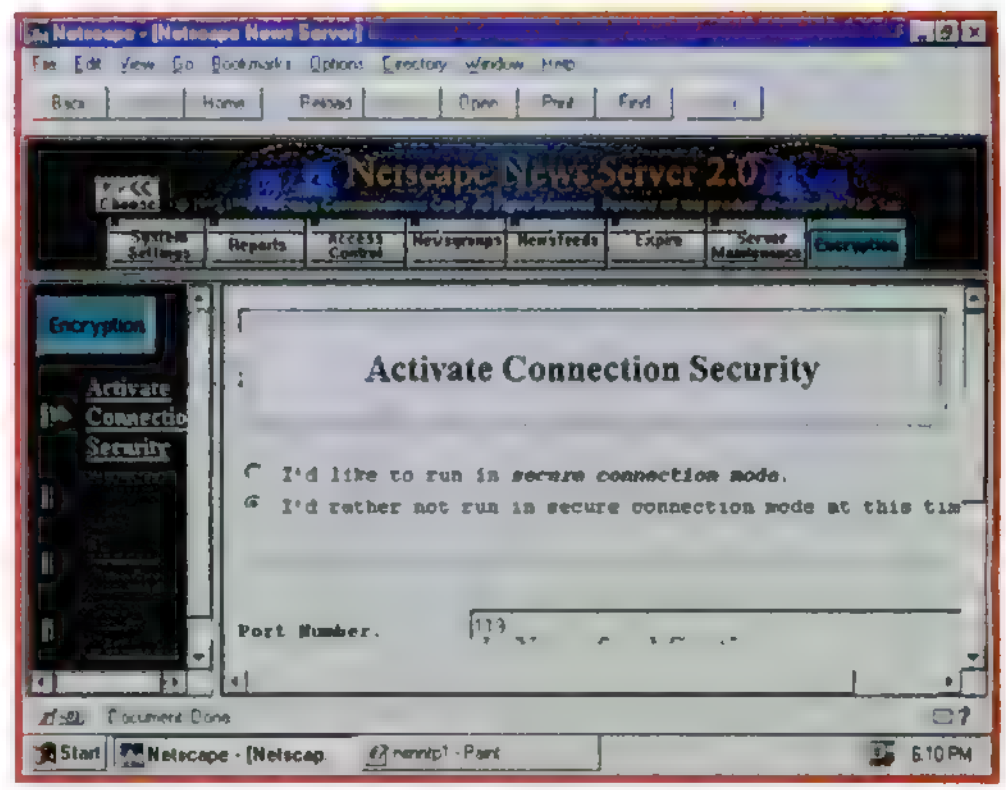
As with other Netscape servers, configuration and management of Netscape News Server is done through a Web browser (Netscape Navigator) interface, but this interface is a big departure from the standard Windows user interface. The control panel, for example, consists of a three-paned window with the top frame serving as a general menu bar.

Netscape News Server can be configured in three different ways using access control lists (ACLs). As a private discussions group server, the system can contain multiple encrypted, password-activated newsgroups. As a public discussions group server, it can contain unrestricted, nonencrypted groups. And as a semiprivate server, it can contain both private and public groups. In each case, the system can be configured to replicate groups internally, externally, or not at all.



Netscape Navigator serves as the interface for Netscape News Server, providing an easy-to-use console for initial server configuration as well as for simple management of all server functions.

Access control in News Server is quite sophisticated, allowing individual users as well as user groups. Netscape also allows you to import a list of users from a text file. You can set read/write privileges based on identity, with or without authentication. Access to individual discussion groups can be controlled through user-name and password pairs, IP addresses, and/or DNS variables, such as the user's domain name. Configuration options for newsfeeds, article expiration, and newsgroup creation and management are all equally sophisticated, though they require a good understanding of Usenet to configure.



Netscape News Server incorporates advanced, flexible security features that allow you to encrypt communication from Netscape Navigator when managing your system or when communicating with private discussion groups.

Netscape News Server supports Secure Sockets Layer (SSL) 3.0., providing encrypted communications between client and server, and server authentication between servers. It is compatible with any Usenet-compliant news server and supports rich content in discussion threads, including HTML, MIME, .GIF, and JPEG. The product shares a common user database with other SuiteSpot servers and provides extensive logging and event-monitoring. But in contrast to Microsoft News Server, it won't let you use the Windows NT Performance Monitor to track server activity.

The News Server help facility is far easier to use than those of other Netscape products. When you click on the Help button, you get a two-frame window that replicates the standard Windows help structure but uses HTML pages instead.

COMING UP

The upcoming version of Netscape News Server will be called Collabra Server 3.0; it will integrate the Collabra server products with the current NNTP Server. A slight contradiction exists in the claimed openness of this product in that though the server will allow existing NNTP clients and servers to communicate with it, to get the full functionality of the product you'll need to use the Netscape Communicator client. One interesting feature is an SMTP gateway that will allow News Server to integrate mail-only clients into a discussion group, allowing the server to function as a list server as well as a discussion server. Also part of the news server push is the emphasis on "rich" content, which, according to Netscape, is an HTML-formatted page. Again, this functionality will require Netscape's client.

On the server side, moving to the Collabra design will allow hierarchical forums to be more intuitive than the existing Usenet standards. Cross-forum search-and-notification tools will make it easier to find the information you need, and a plug-in API will allow developers to write custom solutions. Collabra will retain the ability to conduct SSL, thus providing encrypted communication, and will create X.509 certificates, allowing it to authenticate users. The new server will manage user data and user access through the new LDAP directory service.

Even before the move to Collabra, this version of Netscape News Server is significantly more powerful and flexible than Microsoft Internet News Server, especially with regard to the granularity Netscape's product allows in the administration of users, groups, and discussion groups. But Netscape News Server is also a more complex product to configure and administer. If you plan on running a complex NNTP-based discussion infrastructure for your intranet or a full Internet newsfeed, Netscape is a more sophisticated product and a better choice.

Netscape News Server 2.01. List price: $995. Netscape Communications Corp., Mountain View, CA; 800-638-7483; fax, 415-528-4125; www.netscape.com. *Circle 473 on reader service card.* □

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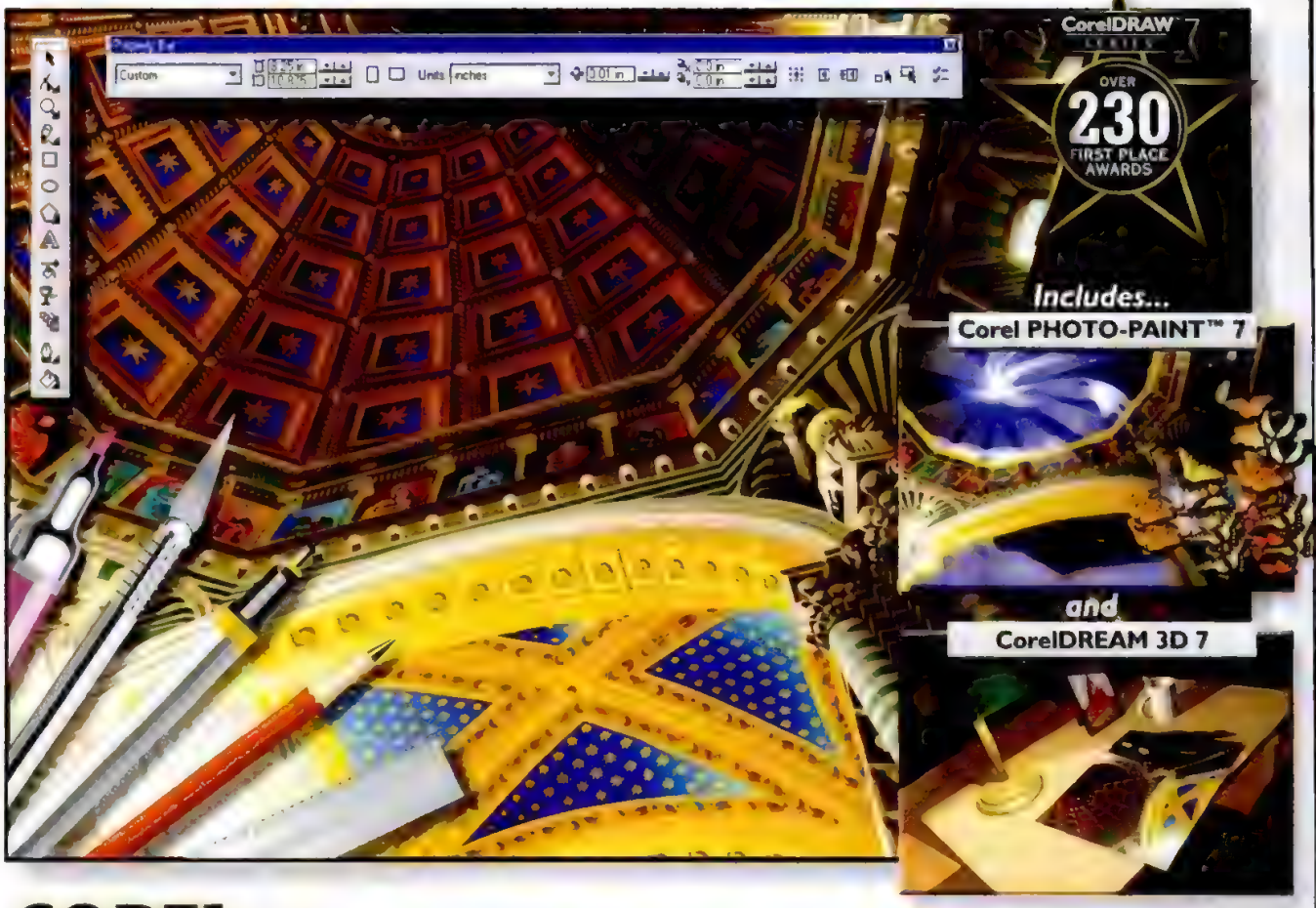

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By Jeff Prosise

Mass Data Transit

Three handy techniques for moving large files between PCs.

When was the last time you attempted to transfer a file to another PC by copying it onto a floppy disk, only to discover that the file was too large to fit on the disk? When two PCs are networked, moving large files is no big deal. But in non-networked environments, large files are big problems.

I often need to move 5MB and 10MB files from my notebook computer to my desktop PC and vice versa. Even in compressed form, most 5MB files won't fit on a 1.44MB floppy disk. That's especially true if the file was downloaded from the Web or an online service and already contains compressed data.

Fortunately, you *can* move large files between PCs without investing in a network or a portable hard disk. Here are three ways I've come to rely on when a simple floppy disk won't do the job.

SLICE AND DICE

Longtime readers of *PC Magazine* may remember a utility named SLICE that appeared in the Utilities column back in the bad old days of DOS. Written by Bob Flanders and Michael Holmes, SLICE carves large files into pieces that will fit on floppy disks. The companion utility, SPLICE, is automatically created by SLICE on the first floppy disk. This reassembly utility rebuilds the file for you at the other end.

Using SLICE and SPLICE is easy. To partition a large file named BIGFILE.XLS onto floppy disks in the A: drive, go to the command line, CD to the directory where BIGFILE.XLS is stored, and then type

```
SLICE BIGFILE.XLS A:
```

Follow the prompts and insert disks as SLICE asks for them. To reassemble the file in the C:\EXCEL\DATA directory on another PC, insert the first disk into the A: drive and type

```
A:\SPLICE A: C:\EXCEL\DATA
```

SPLICE will prompt you to reinsert the floppies in the order in which SPLICE created them. (You can save time by numbering the disks so you don't get them mixed up.)

You can download SLICE from PC Magazine Online. (For details, see the sidebar "Getting the Files" in this issue's Utilities column.) In an era when multimegabyte executables are all too common, SLICE (whose size is about 2K) is a reminder that good things can still come in small packages.

PKZIP'S -& OPTION

The biggest drawback to transferring files with SLICE and SPLICE is that the disk count can get out of hand. Moving a file that requires four or five floppies isn't too bad, but anything larger than that calls for more sophisticated measures.

One alternative is PKZIP 2.04g's -& option, which creates an archive spanning multiple floppy disks. Depending on how compressible the file is, the number of disks needed is reduced. Files can typically shrink to about 50 percent of their normal size after compression, meaning a file that would require ten disks with SLICE might require only five with PKZIP.

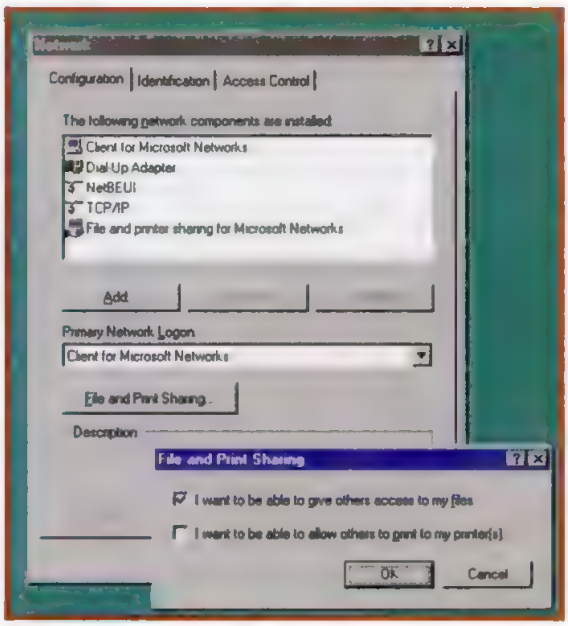

FIGURE 1: *Using this dialog box, you can enable file sharing on a PC running Windows 95.*

Here's how the -& switch is used. Suppose you'd like to compress BIGFILE.XLS onto multiple floppy disks. At the command prompt, type

```
PKZIP -& BIGFILE.ZIP BIGFILE.XLS
```

PKZIP will prompt you to insert disks as needed. To extract BIGFILE.XLS from the archive and onto another PC, put the first disk into the A: drive. Then run PKUNZIP as follows:

```
PKUNZIP A:\BIGFILE.ZIP
```

You'll first be asked to insert the final disk in the archive set. Afterward, PKUNZIP will prompt you to insert the disks in order, from first to last. Once again, it's helpful to number the disks so you know which is which.

DIRECT CABLE CONNECTION

If you need to transfer files between PCs that are in close physical proximity, you can link them together with an inexpensive cable and move the files by wire. Third-party products, such as Traveling Software's LapLink (800-343-8080), come with both the cable and the software you need.

If both PCs are equipped with Windows 95, you don't need additional software: you can use Windows 95's handy Direct Cable Connection (DCC) instead. All you need to make it work is a cable. A null-modem cable will do just fine, but transfers tend to be slow because this type of cable links PCs together by their serial ports. For high-performance file transfers, a parallel-port cable is best. Most parallel-port LapLink cables will work. Extended Capabilities Port (ECP) and Universal Cable Module (UCM) cables work, too, provided your PCs' parallel ports are of the ECP variety. (Most parallel ports on Pentium PCs are.)

Once the source and destination PCs are cabled together, putting DCC to work is easy. If DCC is installed on your PC, there will be a Direct Cable Connection item in the Start menu, under Start | Programs | Accessories. If DCC isn't installed, you can install it by selecting Settings | Control Panel from the Start

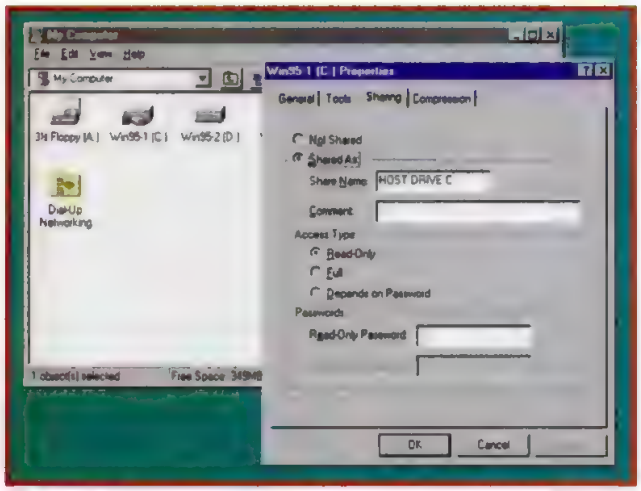

FIGURE 2: *Before you can run Direct Cable Connection (DCC), you need to make the C: drive a shared resource on the host.*

menu, opening Add/Remove Programs, clicking the Windows Setup tab, double-clicking Communications, checking the Direct Cable Connection box, clicking OK a couple of times, and following the instructions on the screen. (You might be prompted to insert the Windows 95 CD.) The first time you run DCC, you'll be asked to designate a host PC (the one that has the files you wish to transfer) and a guest (the one to which the files will go) and to state the port to which the cable is connected.

Before you start DCC on the host PC, you need to specify which of the host's resources are shareable. This means that if you want the guest to be able to copy any file from the host's C: drive, then the C: drive must be designated as a shared resource. To make the C: drive shareable, right-click the Network Neighborhood icon on the desktop and select Properties. On the property sheet's Configuration page, click the File and Print Sharing button. When the dialog appears, check the box labeled "I want to be able to give others access to my files" (see Figure 1). Once file sharing is enabled, make the C: drive a shared resource by right-clicking the drive icon in My Computer or in Windows Explorer, selecting Sharing from the context menu, clicking the Sharing tab in the property sheet, clicking the Shared As button, and entering a name for the shared resource in the Share Name box (see Figure 2).

Once the host's shareable resources are identified, you're ready to go. Start DCC on the host PC and click the Listen button to tell it to listen for a signal from a guest. Then start DCC on the guest PC. After a few seconds, a window will pop up on the guest PC, listing the shared resources on the host. You can browse these resources the same way you browse files and folders in My Computer. To copy a file, just drag it from the window and drop it into a folder on the guest. To copy a group of files (or even entire folders), select the items you wish to copy and do a group drag-and-drop.

DCC's interface isn't as slick as LapLink's, but it's quite functional. It's easy to learn, because the window in which shared resources are displayed looks and acts just like a My Computer window. You can even use DCC to share printers and network resources—remarkable when you consider that beyond the cost of a cable, DCC doesn't cost you a dime.

Of course, none of the aforementioned transfer methods beats having an Iomega Zip drive that you can plug into each PC or having a fast network connection. But for the occasional large file transfer, they're just what the doctor ordered. □

Jeff Prosise is a contributing editor of PC Magazine.

MOVING?

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By Neil J. Rubenking

COM Objects in Delphi, Part 2

Creating four Windows 95 shell-extension COM objects.

Creating COM objects in Delphi is quite different from creating COM objects in C++, although similarities do exist: COM objects support one or more COM interfaces, and a single COM interface can be represented by a Delphi object or a C++ object. When a COM object needs to support multiple interfaces, a C++ implementation uses multiple inheritance to derive an object that inherits from all of the necessary interfaces. Multiple inheritance is not a feature of Delphi, so the Delphi implementation needs to take a different approach.

A Delphi-based, multi-interface COM object must be built from several separate objects. Each required COM interface is represented by a satellite object, descended from the Delphi-supplied IUnknown object type. The satellite object implements the IUnknown interface. The COM object as a whole is represented by a container object, also descended from IUnknown. The container object, which contains instances of the satellite objects as data fields, returns a pointer to the requested interface when its QueryInterface function is called. The first part of this article presented these concepts, along with their implementation, in the ISatelliteUnknown and IContainerUnknown objects. Now we'll use these objects to create shell-extension COM objects for Windows 95.

We'll demonstrate the creation of four Windows 95 shell extensions in Delphi: a context-menu handler, a property-sheet handler, a drag-and-drop handler, and an icon handler. The example shell extensions act on an imaginary file type, DelShellFile, associated with the extension .DEL. A DelShellFile's single line of text represents a whole number; in a real program this would be replaced by some more complex attribute of the file. The four shell extensions will interact with this "magic number." You'll also find a copy-hook-handler shell extension in the source code for this article. But because its implementation didn't require use of the container/satellite system, that extension won't be discussed in the article itself. All code mentioned in this article is available for download from PC Magazine Online. (See the sidebar "Getting the Files" in the Utilities column for details.)

PREPARING HELPER INTERFACES

Figure 1 represents the hierarchy of supporting objects that we'll create. The solid lines define a standard object hierarchy, with the Delphi-defined IUnknown object at the top. Beneath each object's name is a list of the interfaces it supports, omitting the ubiquitous IUnknown interface. The dotted lines represent the container/satellite relationship on which this entire system is based.

The context menu, property sheet, and drag-and-drop-handler shell extensions rely on the IShellExtInit interface for initialization. The icon handler relies on the IPersistFile interface for the same purpose. Figure 2 shows the declarations for satellite objects that implement these two helper interfaces and for container objects that are pre-initialized to handle these satellite objects.

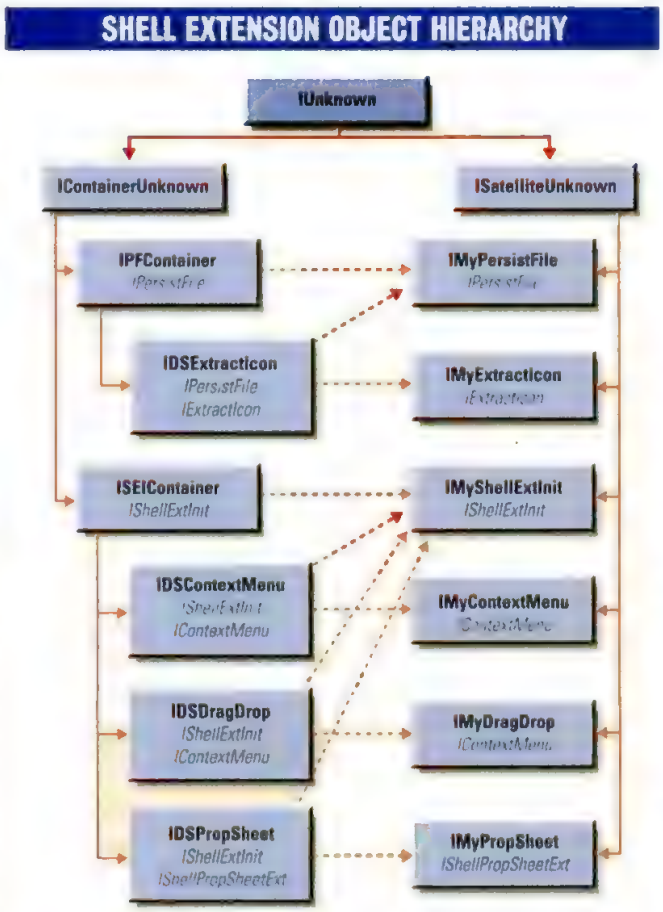

FIGURE 1: *This is the object hierarchy for the Delphi shell extension objects we'll create. Supported interfaces (other than IUnknown) are listed in italics beneath each object name, and dotted lines represent container/satellite relationships.*

The IMyShellExtInit object adds the method Initialize, which implements the IShellExtInit interface's Initialize function. It inherits ISatelliteUnknown's handling of the QueryInterface, AddRef, and Release methods. Thus IMyShellExtInit's virtual method table matches perfectly with the set of functions that defines an IShellExtInit interface. The Initialize method extracts a list of files from data supplied by the calling program and stores it in a data field of its container object, which must be of the type ISEIContainer.

ISEIContainer inherits the AddRef and Release methods of IContainerUnknown. In its implementation of QueryInterface, ISEIContainer first calls the QueryInterface method inherited from IContainerUnknown. If that method doesn't return S_OK, the overriding QueryInterface method checks to see if IShellExtInit is being requested; if so, QueryInterface passes back a pointer to its protected data field FShellExtInit, which is an object of type IMyShellExtInit. ISEIContainer also defines data fields to hold a list of files, the number of files, and a path. Its Create constructor initializes the file list and FShellExtInit objects, and its Destroy destructor frees the

memory used by those two objects.

The IMyPersistFile object looks a lot more complicated than IMyShellExtInit, but five of the six methods that implement functions of the IPersistFile interface simply return the result code E_FAIL. IMyPersistFile's Load method receives a filename in Unicode form; it converts this filename to an ANSI string and stores it in a data field of its container object, which must be of type IPFContainer. Like ISEIContainer, IPFContainer overrides QueryInterface. If the inherited QueryInterface method fails, it checks to see if IPersistFile is being requested. If so, it passes back a pointer, of type IMyPersistFile, to its protected data field FPersistFile. The container object's constructor and destructor methods create and destroy the FPersistFile object as well.

Now we're ready to build the shell extensions themselves.

THE CONTEXT-MENU HANDLER

When you right-click on a file in Windows 95 Explorer, the system checks to see whether a context-menu handler is defined for that file's type. If one is, the system creates an instance of the context-menu handler COM object and passes a list of selected files to the Initialize function of the object's IShellExtInit interface. Then it calls the QueryContextMenu function of the IContextMenu interface. The function uses standard Windows API functions such as InsertMenu to insert menu items or separators; the function's return value is the number of items added, not including separators. The IContextMenu interface's InvokeCommand function is called when the user selects one of the added menu items, and the GetCommandString function is called to supply an explanation of the menu item in Explorer's status bar.

The Delphi objects used to define and initialize a context-menu handler are IMyContextMenu, IDSContextMenu, and ICMClassFactory. IMyContextMenu is an ISatelliteUnknown descendant that implements the three IContextMenu functions. IDSContextMenu is a descendant of ISEIContainer, so it already supports IShellExtInit. IDSContextMenu adds a protected data field, FContextMenu, of type IMyContextMenu. As before, IDSContextMenu's constructor and destructor create and destroy the satellite object, and its QueryInterface method passes back a pointer to the FContextMenu object when IContextMenu is requested.

This unit also defines ICMClassFactory, a descendant of IMyClassFactory that specifically returns an instance of IDSContextMenu. The CreateInstance method creates and returns the requested instance, but only if the interface being requested is one that IDSContextMenu supports. Each of the shell extensions will have a nearly identical IMyClassFactory descendant.

The QueryContextMenu method checks whether or not multiple files are selected. For a single file, it adds a menu item titled Magic Number; for multiple files, it adds an item titled Average Magic Number. The InvokeCommand method displays the requested number in a simple message box after validating its arguments. And the GetCommandString method returns a single-word name for the menu item or a descriptive string, depending on which was requested.

THE DRAG-AND-DROP HANDLER

A drag-and-drop handler is quite similar to a context-menu handler—in fact, it even supports the same IContextMenu interface. The drag-and-drop extension, however, is invoked when a file is dragged with the right mouse button onto a folder, and it is registered to the folder file type, not to the file type of the dragged file. The IMyDragDrop satellite object implements the methods QueryContextMenu, InvokeCommand, and GetCommandString.

The QueryContextMenu method first flips through the list of files supplied by the system and checks whether the files are all of type DelShellFile. If they are, the method adds a menu item named Count Files, along with a

```
type
  IMyShellExtInit = class(ISatelliteUnknown)
  public
    function Initialize(pidlFolder:PItemIDList; lpdobj: IDataObject;
      hKeyProgID:HKEY):HResult; virtual; stdcall;
end;

IMyPersistFile = class(ISatelliteUnknown)
public
  function GetClassID(var classID: TCLSID): HResult; virtual;
    stdcall;
  function IsDirty: HResult; virtual; stdcall;
  function Load(pszFileName: POleStr; dwMode: Longint): HResult;
    virtual; stdcall;
  function Save(pszFileName: POleStr; fRemember: BOOL): HResult;
    virtual; stdcall;
  function SaveCompleted(pszFileName: POleStr): HResult;
    virtual; stdcall;
  function GetCurFile(var pszFileName: POleStr): HResult;
    virtual; stdcall;
end;

ISEIContainer = class(IContainerUnknown)
protected
  FShellExtInit : IMyShellExtInit; // Satellite interface
public
  FNumFiles     : Integer;
  FInitFiles    : TStringList;
  FIDPath       : String;
  Constructor Create;
  destructor Destroy; override;
  function QueryInterface(const WantIID: TIID;
    var ReturnedObject): HResult; override;
end;

IPFContainer = class(IContainerUnknown)
protected
  FPersistFile : IMyPersistFile; // Satellite interface
public
  FPFFilename   : String;
  Constructor Create;
  destructor Destroy; override;
  function QueryInterface(const WantIID: TIID;
    var ReturnedObject): HResult; override;
end;
```

FIGURE 2: *Two satellite objects implement the helper interfaces required by context-menu, property-sheet, drag-and-drop, and icon-handler Windows 95 shell extensions.*

COM Object Debugging

Most modern development environments include an integrated debugging feature that lets you step through or trace code, set breakpoints, and watch variables. But when your code resides in a DLL rather than in an executable program, integrated debuggers can't help you. Even if you use a 32-bit standalone debugger, COM objects won't be easily accessible, because they operate in the memory context of the object or program that calls them. For example, if the COM objects in question are Windows 95 shell extensions, they run in Windows Explorer's memory space.

In many cases, the questions you'd want a debugger to answer about your COM objects are quite simple: Was the DLL activated at all? Did the system try to create an instance of the COM object? Which interface was requested? Such questions can be handled by a simple message-logging technique in which the COM object broadcasts a status message that is received by a separate logging program. The unit DllDebug, available from PC Magazine Online, implements the broadcast side of this process.

The unit's initialization section sets the WM_LOGGIT variable to the unique message identifier that's obtained by passing the string Debugging Status Message to the RegisterWindowMessage function. The first call to RegisterWindowMessage using a given string will return a unique message number; subsequent calls using the same string will return the same message number.

Because 32-bit programs use separate memory contexts, the Loggit function can't simply pass a pointer to the status message string itself. The pointer would be invalid in the receiving program's memory context. Instead, the Loggit function adds the status message to the global atom table. It calls SendMessage, passing -1 as the window handle, WM_LOGGIT as the message number, and the atom as the wParam. SendMessage doesn't return until all top-level windows have had a chance to process the message. At that point, the atom can safely be deleted.

The NameOfIID function, also included in the DLLDebug unit, will come in handy when composing status messages. As written, it reports the name of IIDs related to shell extensions, but you can add any system IID values that are relevant to your project. So, for example, within a QueryInterface method you might insert the line:

```
Loggit(Format('QueryInterface: %s requested',
  [NameOfIID(WantIID)]));
```

Broadcasting the WM_LOGGIT message is half the job; now we need a program to receive and log the status message. The Logger program, also available online, demonstrates one way to handle that task.

Since the value of the WM_LOGGIT message isn't known until run time, it's not possible to set up a standard message-handling method. Instead, the program overrides the form's DefaultHandler method. When a WM_LOGGIT message comes through, this method extracts the status message from the passed atom and adds it to a list box. Besides this core functionality, the program includes three buttons that allow you to insert a comment, clear the list box, and save the logged status messages to a file. Figure A shows the Logger program in action.

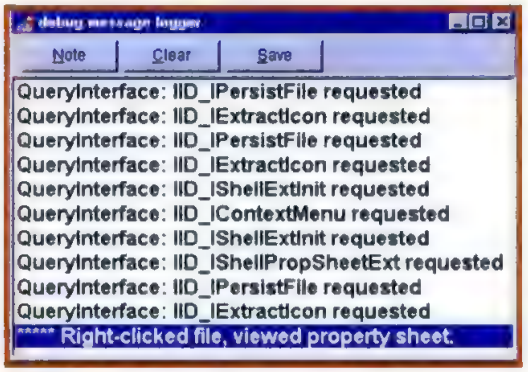

FIGURE A: *This simple debug message logger adds received status messages to a list box.*

In this dialog box, the QueryInterface methods of several Delphi-based COM objects have been "instrumented" with a line that logs the name of the requested interface. This list of requests occurred when Explorer initially extracted a particular file's icon, after which the user right-clicked the file and viewed its properties; everything worked correctly. If the logger shows unexpected results, you'll add more calls to the Loggit function around the problem area and try again until you've identified the source of the problem.

separator, and returns 1; if not, it does nothing and returns 0. When the menu item is chosen, the InvokeCommand method counts the files in the dropped-on folder and adds the number of files to the magic number of each selected DelShellFile. Because a DelShellFile's icon depends on its magic number, a call to the API function SHChangeNotify tells the system to redisplay each of the files.

The IDSDragDrop container object is functionally identical to the IDSContextMenu object. It simply maintains a satellite object of type IMyDragDrop rather than IMyContextMenu.

THE PROPERTY-SHEET HANDLER

When the user selects Properties from the context menu for one or more selected files of the same file type, the system checks to see if a property-sheet handler is defined for that file type. If so, the system creates an instance of the shell extension and initializes it with a list of files via the IShellExtInit interface's Initialize function. The system also calls the AddPages function of the IShellPropSheetExt interface to allow the property-sheet handler to add one or more property pages. The other IShellPropSheetExt interface function, ReplacePages, is normally not implemented.

Delphi programmers will suddenly find themselves in *terra incognita* when implementing AddPages. In order to create the property-sheet page, you must supply a dialog-box template resource and a dialog-box function. Only old-time Windows programmers will remember those hoary precursors to today's visual development style. You can use a resource-creation tool like Borland's Resource Workshop to create the dialog template, or create the resource script as text and compile it with the BRCC.EXE resource compiler that comes with Delphi. The resource script that defines the DelShellFile property sheet is included with the downloadable source code.

This resource script defines two statics (labels), a list box, and a button. The constants IDC_Static, IDC_ListBox, and IDC_Button, used as control ID numbers, are defined in the shared include file, SHEET.INC.

The AddPages method initializes various fields of a TPropSheetPage structure, including the dialog-box template, the dialog-box procedure, and the program-defined lParam. Here, lParam holds the list of files passed by the shell. The callback function serves to ensure that this list gets deallocated. A call to CreatePropertySheetPage creates a page based on the TPropSheetPage

structure, and a call to the shell-supplied lpfnAddPage function adds the page to the Properties dialog.

The dialog-box procedure handles two specific messages. On a WM_INITDIALOG message, it adds to the list box the list of files pointed to by the lParam field of the property sheet page, preceding each with its magic number. The procedure sets the static control to reflect the number of files selected. It then disposes of the file list, and sets the field that held the file list to 0.

When the user clicks the Zero Out button, the dialog-box procedure receives a WM_COMMAND message with the low word of the wParam set to the button's ID. The dialog-box procedure steps through the list of files, sets each file's magic number to 0, and calls the SHChangeNotify API function to signal a need to redisplay the file's icon. Virtually every property-sheet dialog-box procedure will need to respond to WM_INITDIALOG in order to initialize its controls. If it does more than just display information, it will need to respond to WM_COMMAND messages from particular controls as well.

THE ICON HANDLER

In most cases, the Windows 95 shell gets the icon for a file by checking the DefaultIcon key below the Registry key for the file's type. But if DefaultIcon is set to %1, the shell will call the file's icon-handler shell extension instead. The system calls the Load function of the icon handler's IPersistFile interface, passing the name of the file. The icon handler can supply a file-specific icon through the IExtractIcon interface's GetIconLocation and Extract functions, either by giving the filename and index for an icon resource or by creating an icon on demand.

The example IMyExtractIcon satellite object implements both possibilities. If the conditional compilation directive UseResource is defined, the GetIconLocation method copies the name of the DLL containing the IMyExtractIcon object into the szIconFile argument, then calculates the value of the piIndex argument from the file's magic number. The method sets the pwFlags argument to include GIL_PERINSTANCE, meaning each file may have a different icon, and GIL_DONTCACHE, meaning the system should not cache the icon. The Extract method is not used; it simply returns S_FALSE.

When the UseResource conditional compilation directive is not defined, the IMyExtractIcon satellite object creates an icon for each file. The GetIconLocation method stores the file's magic number in the piIndex argument and uses the same flags, plus the GIL_NOTFILENAME flag. The shell calls the Extract method, which creates both a large and a small icon for the file. The height of the red bar within the icon's rectangle is determined by the file's magic number. The source code demonstrates on-the-fly icon creation, but since this is tangential to the article's topic, we won't discuss its details here.

PACKAGING THE PRODUCT

To put your shell extensions to work, you must compile them into a DLL that implements the standard functions DLLGetClassObject and DLLCanUnloadNow. The code that defines this DLL is included with the article's source code. DLLGetClassObject determines which object is being requested, creates a class factory to match, and returns the object created by the class factory. The code that defines this DLL is included with the article's source code, a simple console application that handles registering and unregistering all of the example shell extensions.

Before building your own shell extensions based on the examples, be sure to generate new Globally Unique Identifiers (GUIDs) to replace all of the GUIDs in the code. You can do this with the GUIDS program presented in the previous installment of this column. □

Neil J. Rubenking is contributing technical editor of PC Magazine.

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By Linden deCarmo

Fast as a Dart: OS/2's Direct Audio RouTines

Better audio support in OS/2 4.0.

Powerful but slow—OS/2's multimedia implementation has struggled to overcome that label since its inception. The reputation arose because of the multitude of layers used in OS/2's multimedia subsystem. Although those layers enable advanced multimedia features, such as device sharing and robust multithreading, they also hurt performance. With the release of DART (Direct Audio RouTines) in OS/2 4.0, IBM has added a high-speed audio component that has the potential to address many longstanding problems. In this article, we'll determine if DART really fixes all of OS/2's multimedia performance woes, give you tips on how DART should be used, and point you to other sources of information. Before DART, developers hoping to squeeze the best performance out of OS/2 were forced to use playlists (here, the term *playlist* denotes a sequence of audio commands that lets a program stream digital audio directly from memory, rather than from files). To use a playlist, you allocate memory, fill it with audio data, and send an MCI_PLAY message to the Media Device Manager (MDM). MDM forwards the command to the Audio Media Control Driver, which tells the streaming subsystem to start playing the playlist (see Figure 1).

The Memory Stream Handler initiates the streaming process and is responsible for copying data from user buffers into "trusted" system memory, and then forwarding those system buffers to the Sync-Stream Manager (SSM). SSM in turn sends the data to the Audio Stream Handler (ADSH), which passes the data to the audio device driver, where it can be played.

Because all the components operate on their own threads, playlists are unlikely to experience audio breakup during heavy load conditions. Unfortunately, while the proliferation of threads ensures robustness, the overhead makes writing performance-sensitive applications virtually impossible (see the table "Limitations of Playlists").

In comparison with playlists, DART has a surprisingly simple architecture (see Figure 2). In fact, DART is composed of only three subsystems: an audio device manager, a multimedia buffer manager, and an event processor. See the table "DART's Advantages" for a summary of benefits.

The low-level audio support used by DART is called the Vendor Specific Device (or VSD) interface. The VSD is a hardware-specific DLL attached to the MCI Amp-Mixer device (the driver that controls audio). The VSD is responsible for supplying the audio device driver with data, manipulating audio attributes (such as volume and balance control), and sharing the device among multiple applications.

To use DART, you open the Amp-Mixer device and send it the MCI_MIX_SETUP message. This initializes the VSD and returns function pointers for playing and recording (mixWrite and mixRead, respectively). After MCI_MIX_SETUP, you need to issue the MCI_BUFFER command to allocate locked memory (the buffers are obtained from the Sync-Stream Manager). Once the memory is allocated, you are ready to play or record. For instance, to play a buffer, you call mixWrite and tell DART the number of buffers to play.

After you've begun to play or record, DART will notify you of any errors and of playback/record completion with a special high-priority thread. This notification scheme is considerably faster than Presentation Manager, and it enables accurate synchronization with video, text, and other multimedia streams. In addition to event notification, DART lets applications pause, stop, and resume streaming via the MCI_PAUSE, MCI_STOP, and MCI_RESUME commands.

Since DART reuses existing subsystems in OS/2 (such as the VSD and SSM), DART-enabled programs not only can coexist with older multimedia applications, but they can also mix the newer calls with older MCI commands. Furthermore, DART is flexible enough to handle more than digital audio—for example, you can use MCI_MIX_SETUP to place the audio driver in MIDI mode. That's important, since OS/2 Warp 3.0 can't play small MIDI buffers (OS/2 Warp 4.0 has a new MIDI subsystem that removes the limitation).

COMMON PROGRAMMER ERRORS

While DART's flexibility is an important asset, it can also be a major liability if it is used incorrectly. Three common errors can keep unwary developers from realizing DART's full potential: inefficient event handlers, poor underrun processing, and bad buffer-size management.

Bloated event-processing routines are a particular source of difficulty for inexperienced DART programmers. Since events arrive on special priority threads, event routines must be as efficient as possible or risk bogging down the entire system. If you must execute a lot of code during an event, you should create a worker thread and have the event routine signal the worker when an event arrives. After the worker thread starts, your event routine can exit.

Many developers are also confused about the relationship between *latency* (the amount of time it takes before a buffer begins to play) and *underruns*, which occur when an application cannot supply audio data to the device driver in a timely manner. Although underruns are

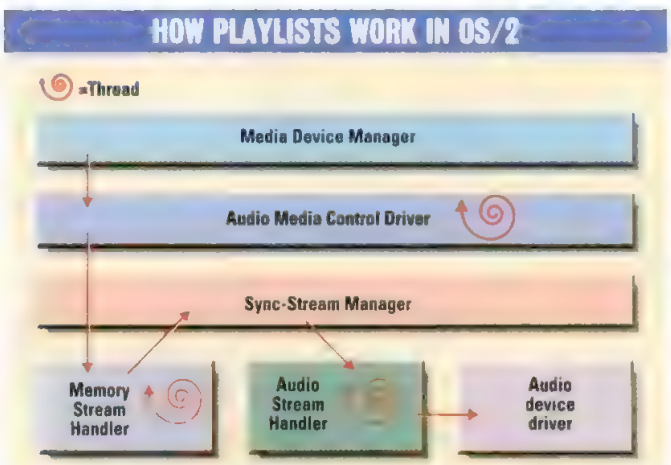

FIGURE 1: *Information is passed from the application to the Media Device Manager and then to the Audio Media Control Driver. The Audio Media Control Driver causes the Memory Stream Handler to send audio data to the Sync-Stream Manager and ultimately to the Audio Stream Handler, which finally forwards data to the audio device driver.*

LIMITATIONS OF PLAYLISTS

Thread overhead	A minimum of three threads is necessary to start a playlist, and once the playlist has been started, at least two threads are used for audio playback. (Some devices, such as IBM's MWave, use more.) This proliferation of threads affects performance, since each thread requires a context switch in order to execute.
Notification mechanism	Playlists use Presentation Manager (PM) to notify applications of events or errors. PM is adequate for most programs, but it is too slow for games and other high-speed audio applications.
Long code path	Although OS/2's device independence allows multimedia applications to work on a wide variety of hardware, the device-independent layers hurt performance.
Memory copies	OS/2 audio drivers require memory buffers to be locked (that is, made nonswappable) before they can be played. But because the buffers used by playlists cannot be locked by an application, the data must be copied by the Memory Stream Handler into a locked or "trusted" buffer that OS/2 secretly allocates.
No control over buffer sizes	Because playlist applications have no control over the size of the buffers that OS/2 uses, the applications often suffer from latency. OS/2 normally uses large buffers for audio streaming, so it takes longer before any subsequent buffer can begin playing.

not fatal, they do cause gaps or noise in audio playback. To minimize such gaps, DART attempts to maintain at least two buffers in the device driver at all times. DART also encourages the use of tiny buffers to reduce latency, and because of that, some developers persist in supplying DART with a single tiny buffer. As a result, their programs may not suffer from latency, but they are vulnerable to underruns. In reality, keeping DART supplied with two to five small buffers will prevent underruns and minimize latency.

DART ARCHITECTURE

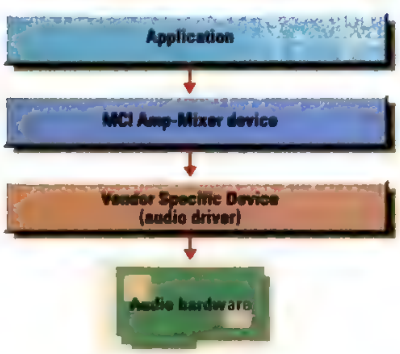

FIGURE 2: *Applications communicate directly with the Amp-Mixer device to control audio hardware.*

A third common mistake is the use of varying buffer sizes when playing or recording. For example, if you allocate three 1,024-byte buffers but tell DART when you start playback that they are really 512, 768, and 128 bytes, the audio device driver may become confused. It is not technically illegal to change buffer size, but many audio drivers assume that all buffers will be uniform and may experience serious problems if varying buffer sizes are encountered.

LIMITATIONS

Although DART represents a tremendous advance over playlists, it is missing some essential features for game writers—notably the lack of support for mixing (combining two or more audio streams). Because most multimedia programs must play several sounds simultaneously, developers need to write or purchase special mixing routines; one such solution is DSMI/2 (*www.netsrq.com/~madbrain*).

DART is also unable to take advantage of hardware acceleration in newer audio chip sets. For example, rather than transferring digital audio continuously across a bus, these devices let applications access memory on a card directly and thereby obtain a significant performance boost. Unfortunately, the current release of DART doesn't support this functionality. DART is also unable to take advantage of audio devices that have hardware mixing capabilities.

A third limitation is DART's lack of whiz-bang features. For instance, DART has no 3-D support. As a result, each application developer must either write his own audio effects routines or purchase a sound effects library.

Finally, DART does not hide the underlying limitations of the OS/2-Intel architecture from the programmer. For example, DART will not allocate buffers greater than 64K, since buffers larger than that could create problems for 16-bit audio drivers. Even more troubling is the fact that DART must create a Global Descriptor Table (or GDT) entry for every buffer it allocates (some audio drivers require a GDT in order to access a buffer). Since the number of GDTs available to the OS/2 multimedia subsystem is limited, a memory-hungry DART application could prevent other multimedia applications from functioning.

If you are interested in experimenting with DART (or if you have a DART-enabled application you want to use) and you have a version of OS/2 Warp prior to 4.0, you'll need to obtain two DLLs (AMPMXMCD.DLL and AUDIOIF.DLL) from either the Developers Connection CD-ROM (Volume 8 or later) or from *www.Polsci.Wvu.Edu/Henry/Files/Drivers/Dart.zip*. OS/2 4.0 supports DART, so users don't need to download these DLLs.

Although DART requires updated DLLs, you don't necessarily have to obtain new audio device drivers, because DART continues to use the existing 16-bit audio device driver interface. Unfortunately, many existing drivers have problems with small buffers, and since DART encourages the use of tiny buffers to reduce latency, you may have to obtain updated drivers to address the problem.

Although it has limitations, DART is clearly a dramatic improvement over the audio support in previous versions of OS/2. It is already a viable platform for performance-critical applications, and if IBM is able to add mixing capabilities and hardware acceleration support and to address the other issues discussed here, DART may well become a superior environment for OS/2 game developers as well.

FOR MORE INFORMATION

To appreciate why DART represents a significant advance over previous OS/2 multimedia solutions, you should be familiar with the Media Control Interface (MCI), the Sync-Stream Manager (SSM), and the Media Device Manager (MDM). For more information, take a look at "Creating a Multimedia CD Player Using REXX," *PC Magazine*, June 11, 1996 (*www.pcmag.com/issues/1511/pcmg0083.htm*), or *OS/2 Warp Unleashed*, by David Moskowitz and David Kerr (Sams, 1995). Additional information on VSDs can be found in "OS/2 Enters the DSP Age," in *The Developer Connection News*, Volume 5; to learn more about DART, see "Ultra-Fast Audio for Games and Multimedia," in *The Developer Connection News*, Volume 8. And *The Design of OS/2*, by H.M. Deitel and M.S. Kogan (Addison-Wesley, 1992), is a good source for general information on the architecture of OS/2. □

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DART'S ADVANTAGES

Threads	DART uses just the application's thread to process buffers. Thus, it minimizes context switches in the central processor.
Memory allocation	DART lets programs allocate "locked" memory, avoiding memory copies.
Buffer control	DART allows applications to control the size of the buffers sent to the audio driver. DART programs thus have greater control over latency.
Notifications	DART uses a special, high-priority thread for event and error notifications. As a result, accurate synchronization is possible.
No layers of overhead	Programs communicate directly with the Amp-Mixer and the VSD. By contrast, playlists must go through the Media Device Manager, Audio Media Control Driver, Memory Stream Handler, Audio Stream Handler, and, finally, the VSD before a single buffer can be played.

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By Brian Proffit

Intercast Brings the Web to TV

A new technology may change the way you watch television.

Some of our younger readers may not recall that a computer monitor used to be called a *CRT*, which stands for cathode-ray tube. Why should you care? Because Intel has taken advantage of a property of these tubes—the same kind found in televisions—to bring together TV and the World Wide Web.

Originally designed by Intel and now guided by the Intercast Industry Group, Intercast is a technology that lets Web pages be transmitted as part of the standard television signals from broadcasters and cable networks. These aren't the same pages you would see on the Internet, though; they're directly related to what is being broadcast at a particular time. As QVC is displaying a product for sale, for example, it is also "Intercasting" a Web page that provides more product information, such as available sizes or colors (see Figure 1).

Since this information is sent through a cable, no connection to the Internet is necessary to view these pages. But broadcasters do want to provide the variety of hyperlinked pages that experienced Web surfers expect. In order to do that, they may send dozens of different pages, which are cached to your disk drive. That need for disk space is the biggest reason Intercast requires a computer rather than a black box on your television (although that may change when televisions become digital).

HOW DOES IT WORK?

Televisions create an image by firing a beam of electrons from the back of the picture tube to the coating inside the front of the tube. The coating and resulting picture (in the U.S.) are composed of 480 horizontal lines. The electron gun paints the screen 60 times each second (60 Hz), but unlike modern computer monitors, televisions interlace the lines. In other words, the gun paints the even rows during one pass and the odd rows on the next pass. That's why the effective rate of televisions is only 30 frames per second (fps).

When the electron gun reaches the bottom of the tube, it takes a certain period of time for it to be deflected back to the top of the tube. That period is called the Vertical Blanking Interval (VBI). During that time, the picture tube can't be displaying any additional information, but the broadcaster continues to transmit a signal. To allow for this timing difference, television transmitters actually send 525 lines of information for each frame—262.5 lines, 60 times each second. (Yes, half-lines are sent. Did you ever notice a single dot in the middle of your TV at the top and bottom of the picture? That's an artifact of the half-line transmission.)

Television transmitters, therefore, are sending 45 lines of information, 30 times each second, that aren't being used for displaying a picture. If you adjust the horizontal hold of your television so that it starts drifting up, you'll notice a black area that separates sections of the picture. That's the VBI. For some time now, Closed Captioning text for the hearing impaired has been sent in the VBI. That limited bit of text, though, takes only one line of the VBI.

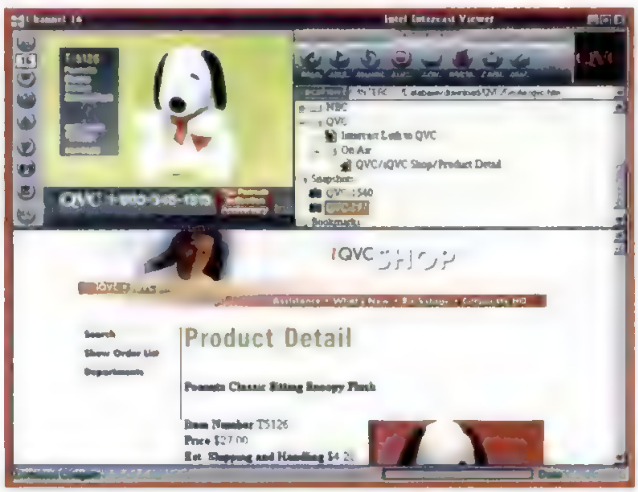

FIGURE 1: *While viewing the live show in a TV window, additional information is displayed in Web pages below.*

Broadcasters use other parts of the VBI to communicate with local stations and cable operators. Did you ever wonder how local commercials are interspersed so precisely with network feeds—particularly during sports events, when the moment a commercial will start is unpredictable? Broadcasters send clock signals and commercial-timing information to the local provider through the VBI.

The format of the VBI is defined by the National Association of Broadcast Transmission Standards (NABTS). The content of ten lines in the NABTS VBI standard is undefined, and this is the area Intercast uses for transmission of packets of computer data. Note, though, that Intercast has not become part of NABTS. In the words of an Intel spokesperson, "Those lines are first-come, first-served. That's why we were so anxious to get broadcasters using this space before somebody else tried to get them for something else."

AS FAST AS ISDN CONNECTIONS

Even with a cable connection, chances are good that your picture reception isn't 100-percent perfect on all channels. A little shadowing is acceptable for video images, but when transmitting data, you need absolute accuracy. Over phone lines, there is handshaking going on between the modems to detect errors and retransmit data as needed. Since the signal from TV networks is one-way, that isn't an option for Intercast.

As a result, the Intercast data format includes some redundancy and forward error-correction techniques to ensure that you receive the data accurately. With this extra data stuffed in, Intercast can pack around 350 bits into each line. Using ten lines that are sent 30 times per second, you see a data rate of around 100 Kbps—roughly the equivalent of ISDN throughput. At this point, most broadcasters are using only three of those lines, giving an effective data rate roughly equivalent to that of a 28.8-Kbps modem.

During testing, I used a Hauppauge Computer Works WinCast/TV card to receive the signal. The WinCast card acts as a combination tuner/modem. It handles the display of the live TV image, and the analog/digital conversion of the VBI information. Each line of the VBI is viewed as a separate data packet, which is passed on to the Intel Intercast browser, which comes bundled with the WinCast card. There, a low-level Intercast

decoder extracts the bits, and then the forward error-correction layer filters it into a decoded datastream, which is sent to the Intercast viewer.

A key to the potential success of Intercast is that the decoded datastream is in the same HTML format you would find on the Web. For broadcasters, it means they can create Intercast content using the same HTML tools they already employ for Web pages. Standards for font sizes, colors, positions, embedded graphics, and hyperlinks are already defined. In fact, Intel expects to have Intercast viewers incorporated with other browsers, such as Netscape Navigator. The low-level data format, though, remains an Intel trade secret, and the company doesn't plan to expose an open application programming interface. That means that only Intel can do the work to incorporate Intercast in other browsers.

BACK-CHANNEL HOOKUPS

Everything I've described so far can be done with no connection to the Internet whatsoever. On the other hand, if your computer is connected to the Internet, this can become an interactive environment. First, Intercast Web pages may include hyperlinks to other pages that have been downloaded and cached in the background. But they may also include links to pages out on the Web itself. If you click on one of these, your Internet connection is made and you surf to that page automatically.

Other options can make it even more interactive. The Intercast Web pages from QVC, for example, don't just allow you to learn about an object; they allow you to place an order through your back-channel Internet service provider. During the Olympics, NBC used Intercast to let viewers be judges during the diving competition. Through a separate Internet connection, viewers could enter their scores for a dive and then see, on their Intercast Web pages, average viewers' opinions next to the judges' scores.

FIGURE 2: *CNN Intercasts a live stock ticker and hyperlinks to pages on the Internet.*

MORE THAN JUST HTML

Other types of data besides Web pages can also be included in the Intercast datastream. One of these additional types is *billboard* information. For example, CNN broadcasts a stock ticker in the VBI (see Figure 2). A feature of the Intel Intercast browser allows you to define the stock symbols you want to follow, which are then flashed continually in the browser.

> A key to the potential success of Intercast is that the decoded datastream is in the same HTML format you would find on the Web.

The IIG standard also provides for *trigger* data to be transmitted. Triggers can automatically switch the TV to full screen or even change channels. They can also determine when cached pages should be pulled up for display. This allows broadcasters to begin the download of complex pages well in advance of the time in the program that relates to the page. Then, at just the right moment, the page can be pulled from the disk and displayed.

SHOULD I BOTHER?

Performance is mixed. Since it uses the DirectDraw API, Hauppauge's video image was crystal clear at 30 fps, even in full-screen mode. That means you have to use a PCI video card with a DirectDraw device driver, but the result is a direct transfer of data from TV card to video card, with almost no effect on the workload of the Pentium processor itself.

On the other hand, Intel's Intercast decoder keeps the processor fairly busy, which is why a Pentium is required. One member of the IIG consortium opined that Intel was deliberately not making the decoder available in chip form so that people would receive another nudge away from 486 systems to Pentiums. Worse, Intel's browser is really slow. If you link to the Internet, be prepared for pages to take twice as long to load as they would with Netscape Navigator.

Also, programming is still somewhat sparse. NBC is using Intercast during NFL football games (to transmit information like statistics, game summaries, and so on), "Dateline NBC," and "Homicide." QVC is using it extensively to enhance the shopping channel. CNN is providing regular news updates on Intercast pages, as well as the running the stock ticker. MTV is using it on a limited basis, but its new channel, M2: Music Television, will use Intercast extensively and plans to include the ability to order tickets, plus links to band pages and concert information.

To be fair, this is just the beginning. The browser works fine now, and other broadcasters are likely to jump aboard as Intercast cards and systems begin to sell. NBC uses Intercast so "Homicide" viewers can try solving crimes before the detectives. The Interactive Crime Lab provides additional clues that aren't in the show, providing an experience that those without Intercast are missing. As soon as ABC, CBS, and Fox feel there is a reasonable group of people watching "Homicide" for just that reason, you can bet they'll leap onto the bandwagon.

In the near future, you will see this data-transmission ability used for other things. Imagine downloading software from a TV signal, or ordering something from The Shareware Channel and having it transmitted to your system immediately. And imagine the marketing agreements: Watch "Star Trek: Voyager" and receive a free upgrade to Lotus Word Pro in the background.

HOW DO I GET STARTED?

Right now, there are two ways to begin using Intercast. If you already have a Pentium PCI system, you can plug in Hauppauge's WinCast/TV card for about $99. If you're planning to buy a new system, you might want to consider an AST Advantage! Communications PC, which now comes with Intercast ability built in. Quantex is also offering systems with Intercast built in, and Gateway 2000, IBM, Packard Bell, and Sony have announced they will be shipping Intercast-capable systems in the near future.

Be aware, though, that some locations can't receive the Intercast signal. A few cable companies use the VBI for other things, such as diagnostics. This is rare, but check with your local cable company to be safe. You can also check IIG's Web site, *www.intercast.org*, for more information, including the names of cable companies that pass the VBI through untouched. □

Brian Proffit is a frequent contributor to PC Magazine.

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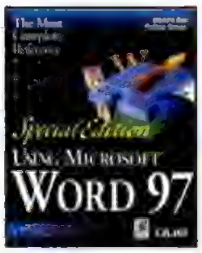

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By Jeff Prosise

Recently Used Programs Redux

RUPL2 adds configuration options and a graphical front end.

Someone once said that the difference between a program and a work of art is that the program is never finished. This little pearl of wisdom speaks to a matter that anyone who has ever developed a piece of software understands all too well: You may think you're finished writing a program, but as soon as it goes out the door, you (or someone else) will think of another feature that should have been included.

I was recently reminded of this adage when a utility I had written—RUPL, which stands for recently used programs list—appeared in *PC Magazine*'s August 1996 Utilities column. RUPL adds a list of recently run programs to the Windows 95 Programs menu (see Figure 1). In the weeks following the program's debut, I received numerous e-mail requests for a feature that, in retrospect, should have been a part of the program to begin with.

A lot of users would like to move RUPL's Recently Used menu from the Programs menu to the Start menu. It sounds simple, but there was no way to do it with the original version of RUPL. Sure, you could manually move the Recently Used menu to the Start menu using the Taskbar Properties window, which is displayed by right-clicking the Taskbar. But RUPL would stubbornly recreate the Recently Used menu in the Programs menu the next time you started a program. RUPL has to know where in the Start menu hierarchy the Recently Used menu lives so it can update that menu whenever a program is started. Because the location of the Recently Used menu was hard-coded into the program, RUPL ignored attempts to move the menu manually.

To make a long story short, the volume of e-mail I received prompted me to revise RUPL so that the Recently Used menu can be moved to the Start menu (see Figure 2). Version 2 of RUPL works equally well in the Start menu or the Programs menu. It also comes with a configuration utility named RUPLCFG that lets you tweak configuration settings without requiring you to edit the Registry.

You can obtain RUPL2 by mail, or by downloading it from PC Magazine Online. (Refer to the sidebar "Getting the Files" for details.) The source code for RUPL2, which was written with Microsoft Visual C++, is also provided, for those interested in seeing how it works.

A FRESH LOOK AT RUPL

In case you weren't tuned in when the first version of RUPL hit the streets, here's a brief refresher on what it is, what it does, and how it came into being.

IN THIS ISSUE

RUPL2

RUPL2 lets you place a Recently Used menu on either the Programs menu or the Start menu. RUPL2 comes with a configuration utility that eliminates the need to use RegEdit for configuration.

In the early days of the Windows 95 beta program, Windows 95 (then code-named "Chicago") kept a list of the 10 or 12 most recently used programs in the Start menu. This incredibly useful little feature made it easy to run a recently used program again, because no matter where on your hard disk the program was stored, you could start it a second time with just a couple of mouse clicks.

Unfortunately, the recently used programs menu was removed from the final version of Windows 95, apparently in keeping with Microsoft's goal to give Windows 95 users a more document-centric view of the world. It was replaced with a menu of recently opened documents. A recent documents menu is useful in and of itself, but it serves a different purpose than a menu of recently used applications.

I wrote RUPL to fill the void left by Microsoft. Each time you start an application, RUPL creates an entry for that application in the Recently Used menu. If necessary, it also deletes the least recently used program name to prevent the menu from growing too long. Over time, the contents of the menu change to include the applications that you've run the most recently. Running any of those programs again is a simple matter of going to the Recently Used menu and selecting a program name.

RUPL2 works just like RUPL, except the location of the Recently Used menu is now a user-configurable option. To specify whether RUPL2 should use the Start menu or the Programs menu, run the companion utility RUPLCFG (see Figure 3). RUPLCFG can be run before or after RUPL2 is installed, and it can be run as often as you like to change the location of the Recently Used menu. It can also be used to make other kinds of configuration changes. We'll talk more about these changes in just a moment.

To install RUPL2, simply create a folder for it on your hard disk and copy the program files—Rupl.exe, Rupllib.dll, and Ruplcfg—to

FOR PROGRAMMERS ONLY Version 2 of RUPL builds on the original RUPL utility, which was presented in the August 1996 Utilities column. The full source code for RUPL2, which was written with Microsoft Visual C++, is available online, along with the article. RUPL2 demonstrates

- how to identify the Start menu folder and its subfolders programmatically;
- how to notify the shell of changes made to those folders;
- how to create .LNK files containing shortcuts to other files;
- how to use Windows 95 ToolHelp functions to gather information about 16- and 32-bit processes;
- how to install global hooks that make use of callback procedures in Win32 DLLs.

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FIGURE 1: *In the original version of RUPL, the Recently Used menu was hard-coded to reside under the Programs menu.*

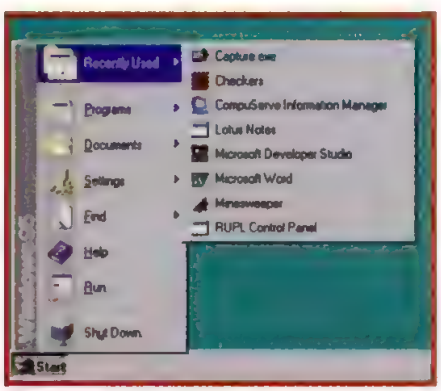

FIGURE 2: *RUPL2's Recently Used menu can be placed in the Start menu or in the Programs menu—your choice.*

that folder. Then create a shortcut to Rupl.exe in your StartUp folder and restart your system.

If you're upgrading to RUPL2 from the original version, follow these steps: Temporarily move the RUPL shortcut from your StartUp folder to some other folder, then restart Windows. This removes the RUPL DLL from memory. Next, copy the RUPL2 files to the same folder where the original RUPL files were stored, and move the RUPL shortcut back into the StartUp folder. Finally, double-click the shortcut to start RUPL.

THE RUPLCFG UTILITY

While I was at it, I couldn't resist adding another enhancement to RUPL. Like its predecessor, RUPL2 stores user-configurable program settings in the Registry—the systemwide database that stores user preferences and other nonvolatile data for the operating system and for the applications it hosts. To alter configuration settings in the original version of RUPL, you had to use RegEdit—the Registry Editor supplied with Windows 95—to add, edit, or delete Registry entries manually. This can be a dangerous, error-prone process; with RUPLCFG, it is unnecessary.

To run RUPLCFG, double-click on Rupl.exe from within Explorer. Besides changing the location of the Recently Used menu, you can make three additional configuration changes with RUPLCFG:

- change the number of program names that appear in the Recently Used menu;
- assign your own descriptive program names to applications added to the menu; and
- prevent certain applications from showing up in the Recently Used menu altogether.

To change the maximum number of program names displayed in the Recently Used menu, enter a value in the box at the bottom of the RUPLCFG window. The default is 15, but you can enter any value from 4 to 64.

Before it adds an entry to the Recently Used menu, RUPL2 attempts to convert the program's .EXE name into a more descriptive program name, such as "Microsoft Word," or "CompuServe Information Manager." If it can't generate a descriptive name, RUPL2 adds the .EXE name to the menu. To assign your own descriptive program name in place of an .EXE name or a default descriptive program name, add the .EXE name and the corresponding descriptive name to RUPLCFG's Descriptive Program Names box. The method for doing so is simple: Click New to create a new entry, then enter the requested information in the ensuing dialog box. To edit an existing entry, click once to highlight it and then click the Change button. To get rid of an entry altogether, highlight it and click Delete.

Sometimes it's useful to exclude a program from the Recently Used menu. Maybe it's a program you don't run very often and don't want taking up valuable real estate in the menu. Or maybe it's a helper program that shows up in the Recently Used menu by mistake. (RUPL2 tries to weed out programs launched by other programs, but its efforts are not 100-percent successful.) You can tell RUPL2 to ignore an application by adding its name to the Excluded Programs list. If you add Winword.exe to the list, for example, Microsoft Word won't be added to the Recently Used menu any more.

After you enter configuration changes with RUPLCFG, click the Apply button to apply the new settings—you don't have to restart the system to make the changes take effect. If you change your mind about some of the changes you've entered, you can cancel out by clicking the Close button and answering no when RUPLCFG asks if you'd like to apply the changes before closing. Remember: Until you apply the changes, you can still change your mind.

REGISTRY PROGRAMMING

There's a lot of cool code in RUPL2, but most of it comes straight from RUPL. Rather than rehash the article in the August issue, let's look at some of the code in RUPLCFG—specifically, at the code that reads and writes Registry data.

The Win32 API includes more than two dozen functions that applications can use to retrieve values from the Registry, write values to it, and perform other Registry-related tasks. Thanks to these API functions, programmers don't have to know anything about the Registry's internal format; instead, they can access it in the same high-level manner in which they access files.

When you think of the Registry, you should think of a big hierarchical database. Keys in the Registry are analogous to subdirectories (or folders) on a hard disk. Each key can be assigned one or more values, which are roughly analogous to files. Values have names and can be written and read with the RegSetValueEx and RegQueryValueEx API functions. Before you read or write a Registry value, you need an HKEY handle identifying the key to which the value belongs.

Writing a value to the Registry is a simple three-step procedure: First, you call RegCreateKeyEx, which either creates a new key or opens an existing key. Then you write a value to that key with RegSetValueEx. Finally, you close the key with RegCloseKey. The following code fragment writes a DWORD value named Placement to the Registry, under HKEY_LOCAL_MACHINE\Software\PC Magazine\RUPL\V1.0, and sets its value to 1:

```
HKEY hKey;
if (RegCreateKeyEx(HKEY_LOCAL_MACHINE,
```

FIGURE 3: *RUPL2's configuration utility lets you select where RUPL2 resides, edit the descriptive names RUPL2 uses for programs, exclude selected programs, and change the limit on the number of entries that can appear in the Recently Used menu.*

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```
"Software\\PC Magazine\\RUPL\\V1.0",
0, NULL, 0, KEY_SET_VALUE, NULL,
&hKey, NULL) == ERROR_SUCCESS) {

DWORD dwValue = 1;
RegSetValueEx (hKey, "Placement",
    0, REG_DWORD, (PBYTE) &dwValue,
    sizeof (dwValue));

RegCloseKey (hKey);
}
```

A return value equal to ERROR_SUCCESS means RegCreateKeyEx successfully opened or created the specified key. The key's handle is copied to the variable whose address is passed in the eighth parameter. The KEY_SET_VALUE parameter passed to RegCreateKeyEx tells the system we want write-access to the key so we can call RegSetValueEx. Given the HKEY handle, RegSetValueEx creates Placement if it doesn't already exist and assigns it the value 1. REG_DWORD identifies Placement's data type—in this case, a simple DWORD. Other commonly used data types include zero-delimited strings (REG_SZ) and binary data of arbitrary length (REG_BINARY).

Reading a value back from the Registry is equally straightforward. The following code retrieves the value of Placement and copies it to a local variable named dwValue:

```
DWORD dwValue = 0;

if (RegOpenKeyEx (HKEY_LOCAL_MACHINE,
   "Software\\PC Magazine\\RUPL\\V1.0",
   0, KEY_QUERY_VALUE, &hKey) ==
   ERROR_SUCCESS) {

   DWORD dwSize = sizeof (dwValue);
   RegQueryValueEx (hKey, "Placement",
        NULL, NULL, (PBYTE) &dwValue,
        &dwSize);
   RegCloseKey (hKey);
}
```

Calling RegOpenKeyEx with a KEY_QUERY_VALUE opens an existing key with permission to query data values, and RegQueryValueEx retrieves a value by name. When RegQueryValueEx returns, dwSize holds the number of bytes retrieved from the Registry. This information isn't important when you know in advance that you're reading a 4-byte DWORD value, but it's terribly important if the value's length is unknown—for example, if you're reading a REG_SZ or REG_BINARY value.

RUPLCFG uses the techniques described in the preceding paragraphs to write two DWORD values to the HKEY_LOCAL_MACHINE\Software\PC Magazine\RUPL\V1.0 Registry key. The first, Placement, indicates whether the Recently Used menu should be placed in the Start menu (0) or in the Programs menu (1). The second, MaxMRU, specifies the maximum number of entries in the Recently Used menu. When started, RUPL2 retrieves these values from the Registry and adapts its actions accordingly.

If you peek inside the source code for RUPLCFG, you'll see that it also creates a pair of subkeys, named Descriptive Names and Excluded Programs, under which it stores lists of descriptive program names and excluded .EXE names. Descriptive program names are written to the Registry as REG_SZ values. Excluded .EXE names are DWORD values that are always set to 0. Before it adds an item to the Recently Used menu, RUPL2 checks to see if the Excluded Programs subkey contains a value whose name is the same as the program's .EXE name. If the answer is yes, the item is not added. It also checks to see if the Descriptive Names subkey contains a value that equals the program's .EXE name. If the check proves positive, RUPL2 uses the value's REG_SZ value as the descriptive program name instead of manufacturing a name of its own.

RUPLCFG uses two other Win32 Registry functions in addition to the ones discussed previously. Before writing a list of descriptive program names or excluded .EXE names to the Registry, RUPLCFG uses RegDeleteKey to delete the existing subkey. This clears out the old values registered under the subkey so that what's recorded in the Registry will exactly match what's shown in RUPLCFG's Excluded Programs and Descriptive Program Names list boxes.

The other Registry function on which RUPLCFG relies is RegEnumKey. Shortly after it's started—but before it displays its window on the screen—RUPLCFG fills the Excluded Programs and Descriptive Program Names list boxes with values enumerated from the Descriptive Names and Excluded Programs subkeys. Given a 0-based index, RegEnumKey returns the name of the value at the specified location under a given subkey. By starting at 0 and incrementing the index until RegEnumKey returns ERROR_NO_MORE_ITEMS, RUPLCFG retrieves the name of every program that appears in the Descriptive Program Names and Excluded Programs lists. For details, see RUPLCFG's EnumExcludedPrograms and EnumDescriptiveNames functions.

RUPL2 is not a from-the-ground-up rewrite of RUPL, but it adds two useful features that make it easier and safer to use. The ability to put RUPL2 on the Start menu means you can find it immediately and access it with one fewer mouse click. The new RUPL2 configuration utility lets you change your settings without fear of making accidental changes to your Registry. □

Jeff Prosise is a contributing editor of PC Magazine.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

Extracting Files from Windows 95 Cabinets

Your column in the issue of September 24, 1996, listed a series of steps to locate and extract a file from the Windows 95 CD-ROM. My system doesn't respond as described in the item. When I double-click on a .CAB file, I don't get a new view window. I suspect that you need to have some accessory installed that provides that "new view window" when you double-click on a .CAB file. Associating .CAB files with EXTRACT.EXE does not provide this functionality.

Once you've found the right .CAB file, however, you can use the EXTRACT utility to obtain the file. The command

```
EXTRACT d:\path\filename.cab
➥filename.ext
```

will extract the specified file and place it in the current directory. If you want the files extracted to a different directory, add the /L switch to specify the location:

```
EXTRACT Win95_02.CAB MSPAINT.EXE /L
➥C:\WINDOWS
```

Note that the space between /L and the target directory name is required. If the target directory name contains embedded spaces or other special characters, you must enclose it in quotation marks.

GREG WOLKING
via ZD Net

PC MAGAZINE: I confess: Microsoft did it! Microsoft's PowerToys utility collection, that is. When the PowerToy called Cabinet File Viewer is loaded, double-clicking on a .CAB file opens it, as if it were a folder. Without Cabinet File Viewer, double-clicking on a .CAB file does nothing. Or rather, it prompts Windows 95 to ask what application you want to use to open the unknown file type. Cabinet File Viewer works invisibly; the reader who submitted the earlier tip didn't remember it had been loaded, and neither did I.

Cabinet File Viewer is a shell extension that makes .CAB files look like folders. You can't use it to put new items into a .CAB file, but it lets you view the cabinet's contents and copy files out. If that sounds useful to you, download the PowerToys collection from Microsoft's Web site or from the WUGNET-managed Microsoft forums on CompuServe. It's free, but Microsoft doesn't support it.

Another Approach to Batch-File Breakout

While reading "A Better Batch-File Breakout" in the User-to-User column of March 12, 1996, I was reminded of what I discovered while trying to figure out how to exit from a batch file even if it was deeply nested. The best approach seems to be avoiding the CALL method altogether. Instead, you pass the name of the mother batch file to the daughter process, along with any other required data. If all goes well, when the daughter process is done it runs the mother process, passing back a parameter that can be used to control the flow of the program. If there is an error, or if the user chooses to quit, the mother file is simply not called and the daughter process ends. The pair of batch files in Figures 1 and 2 illustrate this approach.

This method also allows for a batch file that performs a specific function to be run by any other batch file, since it is passed the name of the file to which to return.

VAL MEHLING
via ZD Net

```
@echo off
if "%1"==""  goto start
if "%1"=="1" goto one
if "%1"=="2" goto two
if "%1"=="3" goto thr
:start
btest atest 1
:one
btest atest 2
:two
btest atest 3
:thr
echo Back from Calls.
```

FIGURE 1: *This batch file passes its own name and a parameter to BTEST.BAT, which actively returns control to this batch file when finished.*

HIGHLIGHTS

HARDWARE Printing forms can be a tricky process. We provide you with a couple of suggestions that may make it a little easier. *Page 224.*

WORD PROCESSING It is possible to choose any printer without affecting your default printer settings, even if you're using Word 6.0; we tell you how it's done. *Page 234.*

SPREADSHEETS Find out how to make sure you're getting all the text when you save an Excel spreadsheet to .DBF format. *Page 234.*

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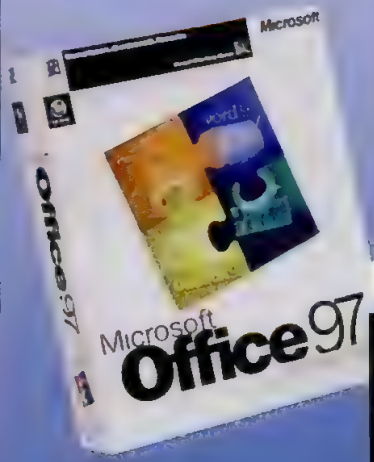

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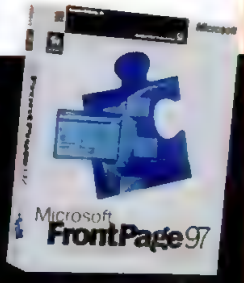

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EtherExpress PRO/10+ PCI combo	134.03
EtherExpress PRO/10+ PCI combo 5-pack	553.34
EtherExpress PRO 100 PCI	131.64
EtherExpress PRO 100 PCI 5-pack	592.28
Express 100BTX 12-port stackable hub	1517.98
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NetPortExpress PRO Enet internal	261.49
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SMC

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EtherEZ 16TC 10BT hub	344.12
EtherEZ 10BT ISA	92.03
EtherEZ 10BT ISA 5-pack	372.03
EtherPower 10BT PCI	117.39
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TigerStack 10BT 12-port hub	499.02
TigerStack 10BT 26-port hub	858.25

DATA STORAGE

COLORADO MEMORY SYSTEMS

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Jumbo 1400 1.3GB TBU internal	183.66
T1000E 800MB TBU external	159.18

iomega

Zip drive 100MB parallel	199.95
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Jaz drive 1GB internal SCSI-2	399.95
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SyQuest

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Microsolutions 4X CD parallel	219.87
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NEC 8V 8X CD internal IDE	151.71
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NEC 8Xe 8X CD external SCSI-2	449.51
Panasonic portable 4X CD SCSI	399.00
Sony portable 4X CD Discman®	302.98
SunMoonStar 8X CD internal IDE/ATAPI	135.24
SunMoonStar 8X CD portable	271.88

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Alps GlidePoint Windows 95 keyboard	95.58
Calcomp Drawing Slate II 6x9 w/pressure pen	195.34
Calcomp Drawing Slate II 12x12 w/pressure pen	217.66
Epson PhotoPC digital camera	399.00
Epson ActionScanning System II	376.41
Epson ES1000C color scanner	572.37
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Play Snappy video still capture	195.97
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Umax Vista-S6E scanner	292.93
Umax Vista-S12 scanner	712.10
Visioneer PaperPort Vx scanner	277.21
Visioneer PaperPort ix scanner	304.36

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Mag Innovision DX1795 PnP 17" .26mm	612.61
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Mag Innovision DX1795E 17" .28mm	529.00
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```
@echo off
echo  This is BTest, called with %%1 = %1 and  %%2 = %2
choice /C:BC   /N "  Press B to Break / C to Continue "
if errorlevel 2 goto next
if errorlevel 1 goto stop
:next
echo  Returning to Mother Process....
echo.
%1 %2
:stop
```

FIGURE 2: *This batch file receives the name of the batch file that executed it as its first parameter; if something goes wrong, it can "break out" by not returning control to its parent.*

```
@ECHO OFF
choice /C:BC /N /TC,2 "%1[B]reak or [C]ontinue? "
if errorlevel 1 if not errorlevel 2 goto stop
CALL %0 %1.
:stop
ECHO %1Leaving
```

FIGURE 3: *This batch file shows what a difference CALL makes—run it with and without CALL at the start of the fourth line.*

PC MAGAZINE: The essential problem is what to do when a nested batch file executed using CALL fails catastrophically. You'd like the batch file to display an error message and then shut down, along with the parent batch file that CALLed it, the batch file that CALLed the parent, and so on. This is not an easy thing to do. The way DOS handles batch files, control is going to be passed back to the CALLing batch file, period. The only way to shut down all CALL-nested batch files is to break out with a simulated Ctrl-Break keystroke. If you abandon CALL, however, a different solution is possible, as the example batch files show.

Figure 3 is another batch file, designed to demonstrate deep nesting of CALLs in a minimum of lines. Run it and press C (for Continue) six or eight times. If you don't press C within 2 seconds, the batch file will do it for you! Each prompt will be indented one space more than the previous. When you press B to break out, each instance of the batch file will print "Leaving" on the screen, indented by the same number of spaces as the prompt. Now delete CALL from the start of the fourth line and run it again. This time, when you press B it breaks out immediately. The "Leaving" line is printed only by the current instance of the batch file.

Kill and Revive the Windows 95 Explorer

When developing DLLs under Windows 95, especially extensions to the Windows 95 shell, you may hit a snag when you try to recompile. If Explorer is using your DLL, the compiler will be unable to write a new version to disk. One solution is to restart Windows or, if your system has network extensions enabled, log off and log on again. A simpler solution, however, is to kill Explorer.

Here's how: Open a DOS prompt, then click on the Start menu and select Shut Down. Then press Ctrl-Alt-Shift and at the same time click on the No button. When you are done, Explorer is down. To get it back, launch Explorer from the DOS prompt.

You can also set a Registry key so that Explorer will automatically unload DLLs more quickly. In RegEdit, navigate to HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Explorer. Add a new key named AlwaysUnloadDll and give it a default value of 1.

DAVID STOCKWELL
Grass Valley, California

PC MAGAZINE: You don't have to be a developer to benefit from this tip. Any time a vendor releases a product without sufficient testing, ordinary users become unofficial beta testers. A buggy program can sometimes leave Explorer in an unstable state. Killing it and restarting it as described here can be substantially faster than restarting Windows, especially on a slower system.

Note, however, that when you restart Explorer, the programs in your StartUp group won't be automatically executed. You'll have to launch each of them by hand. If your StartUp group is bursting with items, reloading them will negate the time saved by not restarting Windows. If your system has user profiles enabled, another way to restart an unstable Explorer quickly is to choose Shut Down from the Start menu and check Close All Programs and Log On as a Different User. Just log on as yourself again and you'll have a fresh copy of Explorer.

Finally, if you need to restart Windows 95 completely but don't want to reboot the system, do this: Bring up the Shut Down Windows dialog and select Restart the Computer. Now hold down the Shift key and click the Yes button. Keep holding down the Shift key until you see "Windows is now restarting..." on the screen. Windows will restart without going through the entire boot process.

Finding the Windows 95 CD-ROM Key

In the September 24, 1996, Solutions column, you explain how to use RegEdit to find your Windows 95 CD-ROM key if you've lost the original CD-ROM sleeve. Although you can use RegEdit to retrieve this information, it's easier with the System Properties program found in the Control Panel. If you click on the system icon, you'll see some basic information about your system in the General (default) tab: Operating System Version, Registered to, and Computer (Processor, RAM). In the Registered to section you'll see a numeric string with groups of five, three, seven, and five digits, separated by dashes. The three- and seven-digit groups are the CD-ROM key. If you are using Microsoft Plus! there will be two of these CD-ROM key numbers. The Windows 95 number is the top one.

NEIL MACIVER
Londonderry, New Hampshire

PC MAGAZINE: For those who missed the September 24, 1996, column, a reader wondered what to do when Windows 95 Setup demands the CD-ROM key number that's printed on the CD's packaging if you don't have the packaging. I advised readers who still had the package to make copies of the CD-ROM key, and also pointed out that as long as Windows 95 is currently installed, you can retrieve the CD-ROM key from the Registry.

Mr. MacIver is one of several readers who wrote in to point out that the CD-ROM key can be obtained from the System Properties applet without ever having to launch the scary RegEdit program. You can start this applet from the Control Panel, as described above, or by right-clicking on the My Computer icon

FIGURE 4: *You can obtain your Windows 95 CD-ROM key from the System Properties applet, as shown here.*

and selecting Properties. Figure 4 shows the location of the two CD-ROM keys.

Apparently, quite a few of our readers simply write the CD-ROM key directly onto the label side of the CD-ROM itself, using anything from a felt-tip pen to a laundry marker. This practice may be safe, but I can't recommend it. There's always a chance that the solvents in a marker's ink could damage the surface of the CD-ROM over time.

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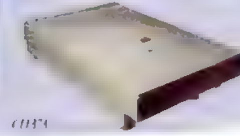

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- 10.4" DSTN VGA
- **Built-In Stereo Sound and Speakers**
- Microsoft Software Bundle*
- **Windows 95**
- **2 Year Limited Warranty[1]**, [illegible]

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- **Windows 95**
- [illegible]

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- **2 Year Limited Warranty[1]**, [illegible]

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- **Microsoft Software Bundle***
- **Windows 95**
- [illegible]

intel inside pentium PROCESSOR

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Ask Our Advisors

HARDWARE

A Plethora of Printers

I have two computers and four printers, and I'd like to be able to print to any of the printers from either computer. I currently use an "X-switch" box that lets the two computers share two printers, but plugging and unplugging the cables for the other printers is a nuisance. Are there any switch boxes that will let me share four printers among two computers? I'm hoping that you can come up with a solution that will work with DOS, because I don't use Windows at all.

ARTHUR HAUG
Punta Gorda, Florida

PC MAGAZINE: This problem has a number of solutions, though none are inexpensive. One approach is to get a manual matrix switch, which would let you combine any input device with any output device. Black Box Corp. sells a four-by-four (four computers and four printers) model for Centronics parallel connections for $510 list (412-746-5500; ask for model SW441A).

Another solution would be to use a printer-sharing system. This is actually a special type of local network; many such systems are designed so you can use simple telephone cords to connect the devices. Typically, a software utility—such as a pop-up TSR—allows you to select which printer to use for a given print job. A set of two computer modules and four printer modules should cost between $250 and $400 (and these cables will be less expensive than those for the matrix switch box).

Both of these approaches work only in one direction; they distribute print jobs to the printers. If you need to share other devices, such as a modem, or ever need to transfer files from one computer to the other, you might want to consider a low-cost local area network. You could probably configure a low-end system for about the same price as the matrix switch; that is, if your desktop system has sufficient power to act as the server for both itself and the notebook.

One note for Windows users: Although Mr. Haug won't have a problem using a printer switch, you might—especially if you're using a late-model laser printer. The latest Windows printer drivers rely heavily on bi-directional communications with laser printers, and this communications link can be broken if you switch to another printer. If you're trying simply to switch between two printers attached to one computer, consider adding another parallel port to your system. It costs much less than a switching device, and there will be no question about whether or not Windows will be able to maintain communication with the printer.—*Alfred Poor*

Fixing Forms

We use a DOS accounting program and an Epson-compatible dot matrix printer to print our billing statements. Unfortunately, each form prints about a line further down the page than the previous form, so we either have to stop and realign the forms in the middle of the print run or print only one statement at a time. Is there any way to keep this from happening?

TONY DOUGLAS
via fax

PC MAGAZINE: You may be able to use printer commands to get the forms to print correctly. You'll need to be able to create text files that contain unprintable characters, such as the Escape character, which in the ASCII character set has a decimal value of 27. Some edi-

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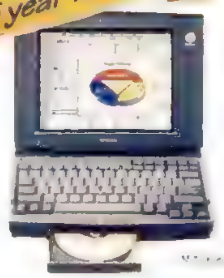

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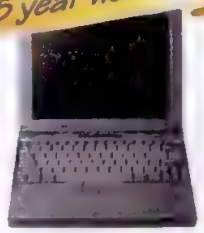

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PC MAGAZINE EDITORS' CHOICE August 1996

For more Editors' Choice Winners, watch for the product listings with the "➡"

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Bravo MS-T P/100 16/2.0GB WIN95	1,365
Bravo MS-T P/133 16/1.2GB WIN95	1,448
Bravo MS-T P/133 16/2.0GB WIN95	1,566
Bravo MS-T P/166 16/1.2GB WIN95	1,722
Bravo MS-T P/166 16/2.0GB WIN95/6X CD-ROM	2,092
Bravo MS-T P/180 16/1.6GB WIN95/NT 4.0	2,127
Bravo MS-T P/200 32/2.5GB WIN95/NT 4.0/6X CD-ROM	2,801

COMPAQ

2000 P/100 8/630MB	$1,091
2000 P/100 8/1.2GB	1,168
2000 P/120 8/1.2GB	1,179
2000 P/133 16/1.28GB	1,445
2000 P/133 16/2.5GB	1,608
2000 P/166 16/1.2GB	1,704
2000 P/200 32/2.5GB	2,306
4000 P/166 16/2.5GB	2,176
4000MT P/166 32/2.5GB	2,570
6000 P/166 32/2.1GB	3,137

HEWLETT PACKARD

510MC 5/100 8/1.2GB	$1,123
510MCX 5/100 8/1.2GB	1,341
515MCX 5/100 8/1.2GB	1,370
515MCX 5/133 16/1.62GB	1,669
515MCX 5/166 16/1.62GB	2,195

IBM

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PC340 P/100 16/1.2GB	1,231
PC340 P/133 16/1.2GB	1,409
PC350 P/100 16/1.2GB	1,540
PC350 P/133 16/1.2GB	1,780
PC350 P/133 16/1.6GB	1,826
PC350 P/166 16/1.6GB	2,130
➡ PC350 P/200 32/1.6GB	2,826

NEC

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Powermate V2133 P/133 16/1.6GB NIC	1,606
Powermate V2133 P/133 16/2.0GB/6X CD-ROM	1,760
Powermate P2166 P/166 16/2.0GB	1,784
Powermate P2166 P/166 16/2.0GB/6X CD-ROM/Zip Drive	2,114
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Powermate P2200 P/200 16/2.0GB	2,079
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➡ TX-C7S 17"	1,039

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Multiscan 20" sf11	1,857

ViewSonic

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ViewSonic 20" G PS	1,152 / 1,428

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matrox

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Mystique 2MB memory upgrade	68

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Imagine 128 1600 4MB PCI	841
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9FXMotion 771 4MB PCI	356

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EtherLink III 3C509B-TPO / 20pk	85 / 1,446
EtherLink III 3C509B-Combo / 5pk / 20pk	116 / 496 / 1,828
Remote 510 ISDN router	749
Remote 520 ISDN router and analog router	874
Remote 530 WAN, ISDN and analog router	1,008
3C900 EtherLink XL PCI combo 5-pk	129 576
3C900 Ethernet XL PCI combo 5-pk	576
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OfficeConnect 8-port hub 3C16700	149
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OfficeConnect Hub 8/TP100	869

intel

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EtherExpress 16 combo / 5pk	115 / 547
➡ [illegible] PCI / 5pk	207 / 999
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TokenExpress PRO ISA LAN adapter	240
NetportExpress EL Ethernet	376
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NetWare V4 11 50 / 100 user	3,604 5,047
ManageWise V2.1 5 / 10 / 25 user	582 934 1,429
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EtherPower combo PCI 5pk	144 666
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Accura 33.6 data/fax Int / Ext	142 / 158

MOTOROLA

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OnlineSURFR V.34 Int / Ext	138 / 169
➡ Marquis Ethernet 28.8	404

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AST Ascentia A Model A41

EDITORIAL PC review

- 120MHz Pentium Processor
- 16MB RAM std. 80MB max
- 1GB Hard Drive
- 11.3" Dual Scan Display
- 6X CD ROM module
- 16-bit audio, stereo speaker, microphone, MPEG and zoomed video
- Two Type II or One Type III PC Card expansion slots

$2,199

IBM ThinkPad 365X

- up to 133MHz Pentium Processor
- 8MB RAM std
- Up to 1GB Hard Drive
- 10.4" Active or 11.3" Dual Display
- 16-bit sound, speakers & microphone
- Infrared port for wireless communications

EDITORIAL PC review

starting at $2,299

2 models available

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- 11.3" Dual Scan
- internal 10X CD ROM module integrated
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- 16-bit sound, speakers & microphone
- Infrared port - wireless data transmission

EDITORIAL PC review

$2,432

PRINTERS

HEWLETT PACKARD

Deskjet 400	$202
Deskjet 820Cxi	389
Deskjet 680C	283
Deskjet 340 Portable Printer	295
[illegible]	[illegible]
[illegible]	[illegible]

Canon

BJC 4100 / BJC 4200	$224 / 279
BJC 240 / BJC 620	179 / 399
BJC 4550	499
LBP 465	359

EPSON

DFX 5000 / DFX 8000 9 Pin	$1,389 / 2,339
FX [illegible]	375
FX [illegible] Pin	286
LQ [illegible]	535
LQ [illegible] 24 Pin	439
LX [illegible] Pin	163
Stylus Color [illegible]	27[illegible] / [illegible]
Stylus Pro [illegible]	358 / [illegible]
Stylus 1520	878

LEXMARK

Optra R+ / Optra RN+	$1,311 / 1,549
Optra LX+ / Optra LXN+	1,936 / 2,339
Optra N240 / Optra N245	2,660 / 3,449
Optra C / Optra C Pro	6,259 / 7,179

OKIDATA

Okipage 4W	$297
ML 395	1,045
ML520 / ML521	385 / 511
ML590 / ML591	449 / 580
OL610e	684
OL600e / OL610e / OL610e PS	349 / 499 / 701

SCANNERS

EPSON

Actionscanning System	$413
ES 1000C Business	563
ES 1200C Pro Scanning	1,099

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ScanJet 4c / 4s	851 / 2,443

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ScanMaker [illegible] Flatbed	1,995
35T Slide Scanner	684
ScanMaker E3	370

UMAX

Vista S6E	$395
[illegible]	[illegible]
Vista S6E PC LE w Photoshop LE	473
Vista S6E PC PRO2 w full Photoshop	581
Gemini [illegible]	1,359
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PowerTape 4000 4.0GB Int / Ext	1,036 / 1,212
T4000	371

iomega

Iomega Ditto Easy 800 Int / Ext	$97 / 144
Iomega Ditto Easy 1200 Int / Ext	217 / 265
Iomega Jaz 1GB Int / Ext	375 / 465
Iomega Jaz Media 1GB / 5pk	117 / 450
[illegible]	[illegible]
Iomega Zip Media 100MB / 3pk / 10pk	18 / 45 / 136

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EZFlyer 230 Parallel Port Drive	$278
EZFlyer 230 Removable Disk 1 Pk / 3Pk	28 / 75
EZFlyer 230 PC Internal SCSI	292

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AST

A41 P120 16MB 1GB 11.3" Dual 6X	$2,199
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tors—such as DOS Edit or Windows 95 WordPad—won't let you enter these characters, but some shareware editors and Windows 3.x Write will. The method you use to enter the character varies from program to program; typically, you hold down the Alt key while you type "027" on the numeric keypad to enter the Escape character. In the examples that follow, we'll refer to characters entered in this way as ASCII(*nnn*), where *nnn* represents the three digits you type on the numeric keypad.

There are two reasons why your printer may be skipping down one line too many as it advances the paper. The first possibility is that it is set to Perforation Skip On. Some Epson printers have a configuration DIP switch that controls this feature, but you can also control it by software. Create a text file named PERFOFF.TXT that contains just the following characters:

```
ASCII(027)O
```

with no space between the Escape character and the uppercase O. You can then send this command to the printer by typing

```
COPY /B PERFOFF.TXT PRN
```

at the DOS prompt. (You can also include the DOS command in a batch file so that the text file is sent to the printer before your accounting program runs.)

If that doesn't fix the problem, you may need to set the form length. Measure the blank form length in either inches or lines. The inches setting will work only if it is a whole number (you can't enter fractions of an inch). To set the form length in inches, create a text file called FORMINCH.TXT containing the following characters:

```
ASCII(027) C ASCII(000) n
```

where you replace *n* with the number of inches for the form length. For example, for an 11-inch form, use the command

```
ASCII(027) C ASCII(000) 11
```

If you need to work in fractional inches, use the number-of-lines command instead. Create a text file called FORMLINE.TXT with the following characters:

```
ASCII(027) C n
```

where *n* is the number of lines for the page. For an 11-inch page with standard 6-line-per-inch spacing, the command would be

```
ASCII(027) C 66
```

At the standard 6 lines per inch, an 11-inch letter-size form will have 66 lines. (This second command may be easier to enter because it does not require the Null character, which has an ASCII value of zero and is particularly difficult to create using most editors.)

Make certain there are no spaces between the characters in these files and that there are no carriage returns or line-feeds, because they will advance the first form a line and upset your alignment. You can check your work by counting the number of characters that should be in the file—for example, two in PERFOFF.TXT—and then check a directory listing to make sure the file contains only that many bytes.

Other printers may use different command sets; check the documentation for the command details for your printer.—*Alfred Poor*

OPERATING ENVIRONMENTS

Restoring OS/2's Internet Connection

I accidentally deleted the Internet Connection for OS/2 folder containing all of the Internet access programs. I finally found WebExplorer in an out-of-the-way directory called \TCPIP\BIN, and I put a shadow of it in a new folder. But when I load it, it doesn't automatically start the dialer program as it used to, so I can't connect. What can I do?

JAMES HUDSON
Syracuse, New York

PC MAGAZINE: Been there! I'm going to give you a two-part answer to this question. The first part won't help you now, but it will the next time this happens. The second part will get you running now.

There are several key files that control the behavior and appearance of OS/2. These include the CONFIG.SYS, OS2.INI, and OS2SYS

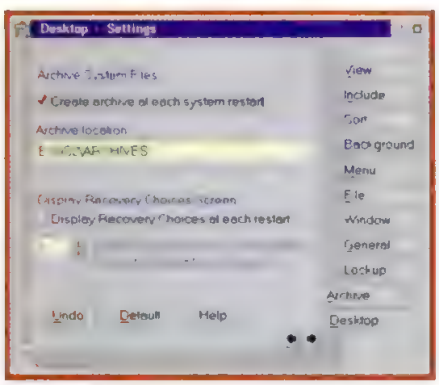

FIGURE 1: *OS/2 lets you archive system files automatically each time you reboot.*

.INI files, as well as the Desktop subdirectory. There's a way to archive all of this information each time you boot your system, so you can easily recover from situations like the one you're in. Move the pointer to an open area on the OS/2 desktop and press the right mouse

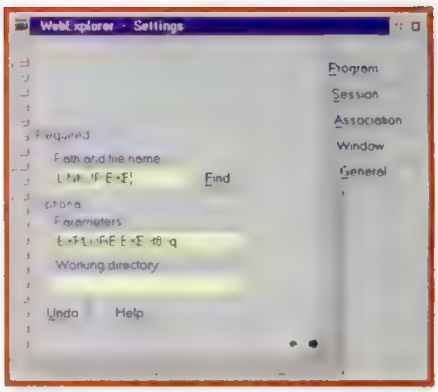

FIGURE 2: *Internet programs are called indirectly through the Linkup program.*

button. From the pop-up menu, click on Settings to access the desktop settings notebook. Now click on the Archive tab to see the dialog shown in Figure 1.

Click in the check box labeled "Create archive at each system restart." Now a copy of the key system files will be created in the \OS2\ARCHIVES subdirectory during the boot process. To save disk space, OS/2 only stores the three most recent sets of files, but that (along with the regular backups I'm sure you perform) is sufficient. At the bottom of the screen, you can tell OS/2 to bring up automatically the panel that allows you to recover from those archives each time you reboot. But since you normally won't need to restore, you probably don't want to add this delay to each boot cycle.

So how do you restore archived files? You need to be alert when you reboot the system. As soon as the "OS/2" appears in the upper-left corner of the screen, press Alt-F1. OS/2 displays a recover screen giving you the option of restoring from the initial configuration created during installation or from any of the archives created during the last three boot cycles. In this case, that would allow you to restore your desktop from an archive created before the folder was deleted.

Since archiving isn't activated by default, you probably don't have any of the system files you need stored yet, and that doesn't get you running now. You found the right subdirectory for all the Internet programs, but the programs aren't called directly. Rather than using shadows of the programs, I suggest you drag Program templates out of the Templates folder and into your new Internet folder. When OS/2 asks you for the program's settings, put the program's filename (plus any parameters you want to specify) in the Optional Parameters field. In the normal program filename field, put LINKUP.EXE (see Figure 2). Linkup is the program that checks to see if a TCP/IP connection already exists. If it does, the program in the parameters field (such as WebExplorer) is loaded automatically. If there isn't a TCP/IP connection, Linkup prompts you for the type of connection and loads the dialer program.

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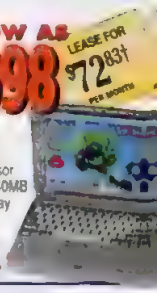

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31103	Pentium/133	SENS 810 P-133	16MB/1.3GB	3399
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While you're still in the Settings dialog for the new program, click on the General tab. Change the title to the label you want for this object—in this case, WebExplorer. Since the program being loaded by this object is Linkup, the object has Linkup's icon assigned to it, rather than the one for WebExplorer. Open the Drives object and then the \TCPIP\BIN folder within it to see the correct icon for WebExplorer. Drag it from the Drives folder and drop it into the Settings notebook. Your setup is complete.—*Brian Proffit*

Handling a Lost Windows 3.x Password

How can I change my screen-saver password when I've forgotten the old password? Disabling password protection is not enough—I really need to change it.

MIKE HSU
via the Internet

PC MAGAZINE: In Windows 3.x, the screen-saver password is stored in CONTROL.INI, in the section titled [Screen Saver]. The value of the key named `Password` is an encrypted version of your lost password. Open CONTROL.INI, locate this `Password=` line, and delete everything after the equal sign. Your screen saver is still password-protected, but the password is an empty string. Now setting a new password is simple.

Looking at this another way, if anyone has access to your system when the screen saver is not running, that person can change your screen-saver password in exactly the same manner described here. Since security seems to be an issue, you will want to activate your password-protected screen saver any time you leave your desk. Here's how: Open WIN.INI and locate the key `Programs` in the section titled [Windows]. Usually, this line will say `Programs=com exe bat pif`. Add `scr` to the list to tell Windows that files with the extension .SCR are executable programs. Now you can create an icon for your screen saver and launch it before leaving your desk. This won't create a truly secure environment, but it will discourage casual snoops.—*Neil J. Rubenking*

WORD PROCESSING

Setting a Printer when Exiting Word

Many people have access to more than one printer, often a laser printer and a color printer. Ideally, it should be easy to direct a print job to a particular printer without affecting your default printer settings.

Lots of programs let you do just that in Windows 3.1. If you choose File | Print | Setup in Microsoft Write, for example, you can choose between using your default printer or a different printer. And if you choose a different printer, you'll find that when you leave Write, your default printer hasn't changed.

Unfortunately, Microsoft Word 6.0 doesn't work that way. To change printers for a particular job in Word, you choose File | Print | Printer. You can then choose any installed printer, but you have to make it the new default to use it. Specifically, you have to choose the button labeled Set As Default Printer. This does just what it says: It resets the Windows default printer. That, in turn, makes it far too easy to print one job to, say, a color printer, then exit Word and forget that you've changed the default printer. If you later reload Word and print a large document or if you load another program and try printing, you'll find you're outputting on the wrong printer.

When I asked Microsoft about this I was told that this is a Windows problem rather than a Word problem, but to me it is clearly Word-related, since other programs can use a specific printer without resetting the default printer. Is there any way to set Word to avoid this problem?

JOHN C. TERMINE
Ellicott City, Maryland

PC MAGAZINE: One way to avoid this problem is to upgrade to Windows 95 and Word 7.0. If you choose File | Print in Word 7.0, you can choose any printer in the Name box without affecting the Windows default printer. You can even open a second copy of Word and find that it's set to use the default printer. The first copy will continue to use whichever printer you've chosen until you change the printer or close that instance of Word.

Of course, this doesn't solve the problem for those who are still using Word 6.0, whether in Windows 3.1 or Windows 95. Fortunately, there is a relatively easy way around the problem: Use a macro to reset the printer automatically whenever you exit Word.

The macro needs only a single line between the Sub MAIN and End Sub statements:

```
FilePrintSetup .Printer = "PRINTER
➡NAME on PORT:"
```

If you create this macro and save it under the name AutoExit, Word will automatically run it whenever you leave the program. Save it under the name AutoClose, and Word will run it whenever you close a file. Either strategy works. Pick the first one if you want to keep the same printer throughout any given session. Pick the second if you want to reset the printer every time you finish with a document.

A slightly more sophisticated approach is to give yourself the choice of whether to reset the printer each time you print. This needs just two lines between the Sub MAIN and End Sub statements:

```
SetPrn = MsgBox("Set Printer to
➡WHATEVER?", "Printer Reset", 4)
If SetPrn = - 1 Then FilePrintSetup
➡.Printer = "PRINTER NAME on PORT:"
```

The first line here creates a dialog box that asks if you want to Set Printer to WHATEVER? WHATEVER? should be the name of your default printer. Printer Reset is the title of the dialog box, and the numeral 4 tells Word to add buttons for Yes and No. Depending on which button you press, Word sets the variable SetPrn to -1 or 0.

The second line tests the value of SetPrn and either resets the default printer or leaves it as is, depending on the value. If you choose the Yes button, SetPrn will be equal to -1 and the macro will reset the default printer.

Here again, if you name this macro AutoExit, it will automatically run whenever you leave Word. If you name it AutoClose, it will run whenever you close a file. The only tricky part of this macro is that the printer name and port as given in the macro must exactly match the printer name and port as given in the Print Setup dialog box. To avoid typographical errors, you may want to create the macro by recording it. Turn on the macro recorder with Tools | Macro | Record, enter the name for the macro, and choose OK. Next, choose File | Print, then click on the Printer button, highlight a printer name, and choose Set as Default Printer. Close the Print Setup dialog box, close the Print dialog box, and stop recording. Finally, you can open the macro for editing and add the first line, as well as the If ... Then statement. Close the macro-editing window, give the File | Save All command to save the macro to disk, and you're done.
—*M. David Stone*

SPREADSHEETS

Saving Excel Spreadsheets to .DBF Format

At my company, we often save Excel spreadsheets to dBASE III (.DBF) format. When we do this, however, we often lose several of the right-most characters in some cells. For instance, what might originally appear in Excel as "Wenatchee, Washington" shows up in dBASE as "Wenatchee, Washi". The only solution we've found is to widen the columns in Excel before saving the file in .DBF format. All characters in the worksheet then make it correctly to the .DBF file.

This is a kludgy solution, though, since it requires first identifying columns that might have problems. Our experience shows that any column can have problems if its original width is too narrow relative to Excel's interpretation of

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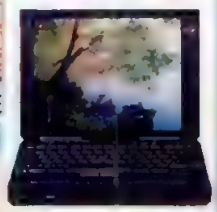
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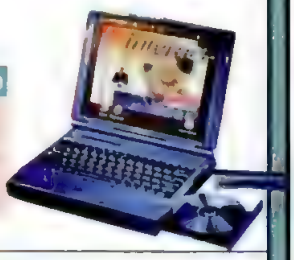
M120T	120MHz	11.8" Active	16MB/1GB	4X	2999
M133T	133MHz	11.8" Active	16MB/1GB	6X	3499
MX133T	133MHz	12.1" Active	16MB/1.35GB	8X	3999
MX150T	150MHz	12.1" Active	16MB/2.1GB	8X	4699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A42	120MHz	12.1" Active	16MB/1.0GB	6X	2999
P50	133MHz	12.1" Active	24MB/1.0GB	6X	3899*
P50	133MHz	12.1" Active	24MB/2.1GB	4X	4299*

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Model	CPU	Screen	RAM/HD	CD	Price
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J30	100MHz	10.4" Active	8/800MB	Opt.	1799
J50	133MHz	10.4" Active	8/800MB	Opt.	2249
J55	133MHz	11.3" Active	16MB/1.0GB	Opt	2399

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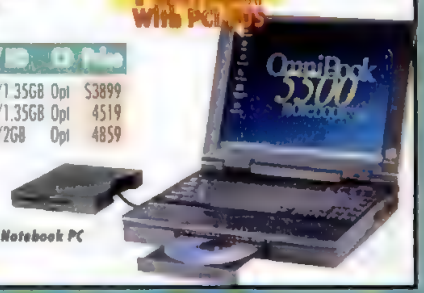

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4716	200MHz	32MB/2.5GB	8X	2199

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Model	Size	View	Resolution	Price
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Presario	17"	15.6"	1280 x 1024	749

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Infinia	17"	16.23"	1280 x 1024	759

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9310	166MHz	24MB/2.5GB	8X	2199 *
9312	166MHz	24MB/2.5GB	8X	2299
9315	166MHz	32MB/2.5GB	8X	2399 *
9314	200MHz	24MB/4.0GB	8X	2299
9316	200MHz	32MB/3.0GB	8X	2699

* Features a 33.6 data/fax/voice modem

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the .DBF format's width requirements. The only general workaround is to widen all columns significantly before exporting. But that forces us either to restore all columns to their original widths afterward or to close the worksheet without saving it again in Excel's format. Got any better ideas?

MATTHEW W. BELL
Seattle, Washington

PC MAGAZINE: When you save an Excel worksheet as a dBASE file, what you see is more or less what dBASE gets. Any text that isn't displayed fully in your Excel columns gets chopped. Worse, for reasons best known only to Excel, even text that does appear in the .XLS file may disappear from the .DBF file.

Widening the columns before export is the surest solution to the problem. You can use the following pair of macros to automate the process. The first macro, after recording the current width of each column on the current worksheet, widens each column to 40 characters. The second macro restores each column to its original width.

```
Dim Widths(256) As Single

Sub Widen()
    For n = 1 To 256
        Widths(n) =
Columns(n).ColumnWidth
    Next
    Columns("A:IV").ColumnWidth = 40
End Sub

Sub Restore()
    Application.ScreenUpdating = False
    For n = 1 To 256
      Columns(n).ColumnWidth =
      ➡Widths(n)
    Next
End Sub
```

The Application.ScreenUpdating statement in the Restore macro isn't necessary, but it makes the macro run more quickly.

To widen to a value other than 40, make the appropriate substitution in the second-to-last line of the Widen macro. Note that you must make your columns wide enough to leave white space on the right side of all text. Simply auto-fitting the columns with

```
Columns("A:IV").AutoFit
```

will probably not make them wide enough.

Enter both macros in the same module sheet, and be sure the Dim Widths statement appears before the first Sub statement. This way, the Widths array will be available to the Restore macro.—*Craig Stinson*

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DATABASES

Comparing Access Databases

Do you know of a program or third-party add-in tool that makes it possible to compare two Access databases and highlight the differences?

MARILYN FORBES
Metairie, Louisiana

PC MAGAZINE: I know of no product that compares databases created with Microsoft Access for Windows 95. For Access 2.0, however, you can use Total Access Detective, a third-party add-on from FMS, an Access tools vendor in Vienna, Virginia. Total Access Detective runs as a library database and is automatically added to Access's File | Add-ins menu. From there, you can call it up to compare two objects in the currently open database easily. To compare objects in two different databases, you would run the Comparison Wizard, whose icon is installed in the Total Access Tools Program Group during installation. You can then choose which databases and objects to compare.

Items that can be checked for differences include object properties, settings, fields, indexes, controls, control properties, sections, section properties, the code behind forms and reports, macro and module lines, records, data permission settings, table relationships—basically everything you'd be interested in checking. When comparing tables, you can opt to check for differences in the data along with the design objects—a big plus—but the table structures of the two tables must be identical for this feature to work.

The product automatically detects differences in the layout information for Forms and Reports, such as controls, sections, and properties. The code behind forms and reports can also be compared. The code in macros and modules can be compared, but this requires an extra preliminary step for each database.

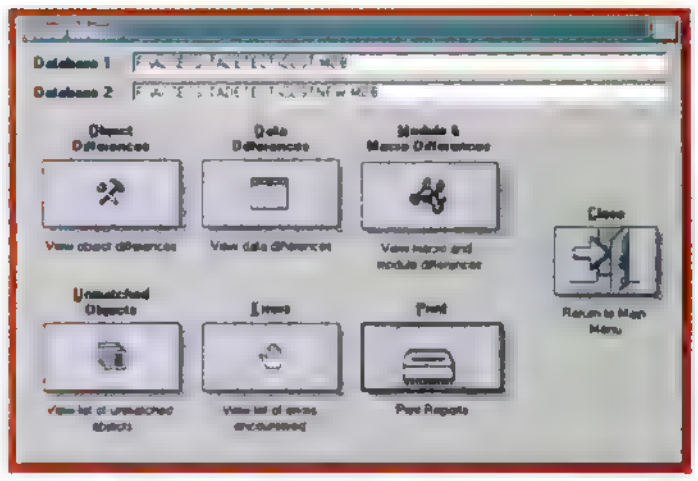

FIGURE 3: *The View Menu in Total Access Detective lets you view the results of comparing two Access 2.0 databases for differences.*

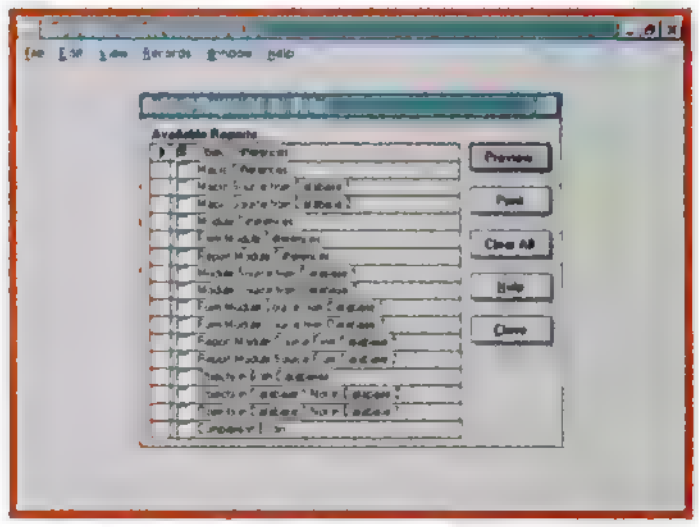

FIGURE 4: *The Total Access Detective reports menu lets you select a number of useful reports that show the results of comparing two databases for differences.*

One interesting aspect of Total Access Detective is the approach it takes in comparing module text. Lines in modules are compared on a line-by-line basis until a difference occurs. Then the product determines whether the difference is due to new lines or to the modification of lines. If the difference is due to new lines, Total Access Detective shows the new lines as being different, but the remaining lines are "resynchronized" so that they are not shown as different, even though their line numbers are no longer the same. The resynchronization is based on an alterable value called "# of lines to resync," which defines the number of consecutive lines. You can also tell Total Access Detective to ignore any differences in indentation it discovers between two code modules.

Once you've compared databases, you can view the results (see the View Menu in Figure 3) or print a number of useful reports. The Reports menu is shown in Figure 4.

Total Access Detective has a list price of $149. For more information, you can reach FMS by phone, at 703-356-4700; via fax, at 703-448-3861; or through the World Wide Web, at *www.fmsinc.com*.—*Sal Ricciardi*

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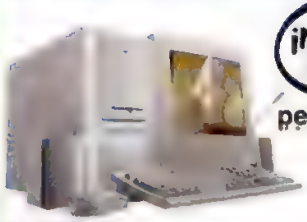

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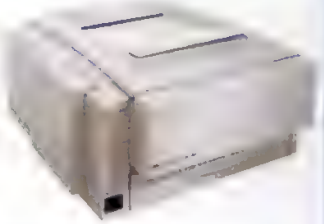

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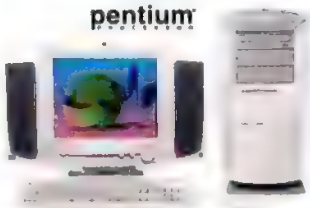

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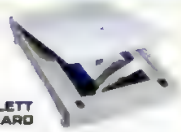

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Premmia LX P/90	8MB KIT	$99
	16MB KIT	$179
	32MB KIT	$329
	64MB KIT	$649
Prem Serv SE 4/33	8MB KIT	$99
Prem 386/33TE, 486/25TE, 486/33TE	8MB KIT	$99
Prem II 386/25, 33, 486/33, 486SX/20 Premium 486/25, 25E, 33, 33E	8MB KIT	$99
Cupid Exp.	0MB BD	$109

NEC

Model	Size	Price
Image/Ready 486/25, 33, 66	4MB MD	$65
	16MB MD	$179
PM 386SX/20i, 20vi, 16i, 25i, 486/50i, 33i	8MB KIT	$129
PM 386/33i, Express Te.e Series	4MB MD	$65
	16MB MD	$189

COMPAQ

Model	Size	Price
Deskpro 5/100, 5/90, 5/75, 4/100, 4/66, 4/50	4MB MD	$69
	8MB MD	$139
	16MB MD	$279
	32MB MD	$489
Deskpro XE 4/100, 4/66, 4/50, 4/33S	4MB MD	$69
	8MB MD	$139
Deskpro 5/66M 5/60M	8MB KIT	$149
	16MB KIT	$279
	32MB KIT	$469
	64MB KIT	$899
	128MB KIT	$1789
ProSignia, Presario	4MB MD	$59
	8MB MD	$99
Presario 500, 700, 900	4MB MD	$55
	8MB MD	$95
	16MB MD	$265
	32MB MD	$465
ProLiant 2000 4000 SystemPro XL	16MB KIT	$269
	32MB KIT	$469
	64MB KIT	$909
ProLinea MT/MTE, ProSignia VS, Presario 600/900, ProLinea 4/25, 4/33, 4/50, 4/66	4MB MD	$69
	8MB MD	$129

IBM

Model	Size	Price
Aptiva 300, 500, 700	4MB MD	$65
	16MB MD	$265
PC 700, 300 series	4MB MD	$55
	8MB MD	$95
	16MB MD	$179
	32MB MD	$329
90Z,55SX,LS,65SX,LS,70-E61,70-121,P-70	2MB MD	$49
55SX,LS,65SX,LS	4MB MD	$59
70-A21 70-A61,70-B21 70-B61	2MB MD	$49
30/286	2MB KIT	$49
57,57SX,90 95	4MB MD	$59
	8MB MD	$99

HEWLETT-PACKARD

Model	Size	Price
Vectra VE, VL3, VL2, XM3, XM2, M2	4MB MD	$59
	8MB MD	$95
	16MB MD	$179
	32MB MD	$329

OTHERS

Brand	Models	Price
ALR	ALL MODELS	CALL
Apple	ALL MODELS	CALL
Canon	ALL MODELS	CALL
Dell	ALL MODELS	CALL
Hewlett-Packard	ALL MODELS	CALL
Sun	ALL MODELS	CALL
Zenith	ALL MODELS	CALL

LAPTOP MEMORY

APPLE

Model	Size	Price
Apple Powerbooks	ALL MODELS	CALL

IBM

IBM RECOMMENDED

Model	Size	Price
CL57SX, Thinkpad 510, 700, 700C, 720, & 720C	4MB	$120
	8MB	$220
Thinkpad 220, 230Cs	4MB	$120
	8MB	$220
Thinkpad 300	8MB	$220
Thinkpad 340, 355, 360, 730	4MB	$120
	8MB	$220
	16MB	$459
Thinkpad 701	4MB	$120
	8MB	$220
	16MB	$459
Thinkpad 710T	4MB	$120
	8MB	$220
PS Note	2MB	CALL
	4MB	CALL
	8MB	CALL
PS Note 425	4MB	CALL
	8MB	CALL
	16MB	CALL
Thinkpad 750, 755	4MB	$120
	8MB	$220
	16MB	$459
	32MB	$989
L40SX, N51	4MB	$120
	8MB	$220

TOSHIBA

Model	Size	Price
Tecra 700 720	8MB	$199
	16MB	$395
	32MB	$499
T400, T405, T410, T415, T610, T100, T105	8MB	$199
	16MB	$299
	32MB	$499
T2100, T2050	4MB	$99
	8MB	$179
	16MB	$279
T2400	4MB	$99
	8MB	$179
T2200SX T2000SX SXE T1800 T1850 T1000SE	4MB	$99
	8MB	$199
T3400, T3600	4MB	$99
	8MB	$179
	16MB	$319
T3100SX, T3200SX/SX	4MB	$120
T5200, T5200C, T5400, T8500	2MB	$79
	8MB	$199
T4400,T6400,T3300	4MB	$120
T4400,T6400	8MB	$199
	16MB	$298
T1900, T1950 T4500, T4600 T4700 T4800 & T4900	4MB	$120
	8MB	$220
	16MB	$299

COMPAQ

Model	Size	Price
Aero, Concerto 486	4MB	$99
	8MB	$189
Contura 400, 410, 420, 430	4MB	$99
	8MB	$199
	16MB	$299
Contura 4/25, 4/33	4MB	$120
	8MB	$199
	16MB	$299
LTE Lite/20,25,25c	4MB	$125
	8MB	$225
LTE Lite 4/25c	4MB	$125
	8MB	$199
ELITE 5000	8MB	$199
	16MB	$299
	32MB	$399
	64MB	$799

DIGITAL

Model	Size	Price
HiNote Ultra	4MB	$135
	8MB	$259
	16MB	$549
HiNote	4MB	$135
	8MB	$259
	16MB	$549

AST

Model	Size	Price
Ascentia J series	8MB	CALL
	16MB	CALL
	32MB	CALL
Ascentia 950N	8MB	$279
	16MB	$575
Ascentia 900, 910	4MB	$119
	8MB	$219
	16MB	$449
Ascentia 800, 810	4MB	$119
	8MB	$219
	16MB	$449

DELL

Model	Size	Price
Latitude XPi, P75, P90	8MB	$169
	16MB	$309

TEXAS INSTRUMENTS

Model	Size	Price
Extensa 550 560	8MB	$279
	16MB	$599
	32MB	$1119
Extensa 450	4MB	$149
	8MB	$289
	16MB	$579
Travelmate 5000 5010 5030 5100 5200	8MB	$229
	16MB	$399

NEC

Model	Size	Price
UltraLite SL/20,SL/20P	4MB	$120
	8MB	$209
Versa S, Versa 2000	4MB	$120
	8MB	$220
	16MB	$599
Versa E, M, V, P	4MB	$120
	8MB	$220
	16MB	$455
	32MB	$995
Ultra Lite Versa	4MB	$120
	8MB	$220
	16MB	$455
Versa 4000	8MB	$220
	16MB	$455
	32MB	$995

CANON

CANON RECOMMENDED

Model	Size	Price
NoteJet IIIcx, Innovabook 1100	8MB	$199
	16MB	$339
	32MB	$599
NoteJet III, Innovabook 1000	4MB	$99
	8MB	$199
	16MB	$299
Innovabook 300, 350, 360	4MB	$125
	8MB	$199
	16MB	$299
NoteJet 486 100C, 75C	4MB	$125
	8MB	$199
	16MB	$299
NoteJet 486 (Original), NoteJet II 486C	4MB	$99
	8MB	$179
	12MB	$199
NoteJet 486-33, 33c, 25c, Innova 486 NX	4MB	$125
	8MB	$199
Innovabook 150C	4MB	$125
	16MB	$329
Innovabook 200LS	4MB	$125
	8MB	$199
	16MB	$299
	24MB	$399
Innovabook 475	8MB	$199
	16MB	$299

PRINTER MEMORY

Model	Size	Price
Brother	ALL MODELS	CALL
Canon	ALL MODELS	CALL
Epson	ALL MODELS	CALL
HP Laserjet II, IID, IIP III IIID	2MB BD	$75
	4MB BD	$125
HP Laserjet 4L	1MB MD	$49
HP Laserjet 4, 4M, 4P, 4si, 4siMX 4lex,XL-300,DJ 1200C, Design Jet 600	4MB MD	$59
	8MB MD	$99
HP 5P 5MP	4MB MD	$59
	8MB MD	$99
	16MB MD	$199
HP 5L	4MB MD	$95
	8MB MD	$219
HP Deskjet 500 500C 520 520C550C 560,560C	256K MD	$38
IBM	ALL MODELS	CALL
NEC Silent Writer 95, 97	2MB BD	$89
Oki Lasers	ALL MODELS	CALL
Panasonic 4420, 4450i, 4410, 4430	2MB MD	$99
	4MB MD	$159

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ACTION TEC

Item	Price
1MB SRAM Card With 2K Attribute	$125
2MB SRAM Card With 2K Attribute	$209
2MB Flash Card	$125
4MB Flash Card	$179
8MB Flash Card	$339
16MB Flash Card	$559
14.4/14.4 Fax/Modem	$89
28.8/14.4 Fax/Modem	$209
10-Base T Network Adapter	$109
Internal Desktop Card Reader	$129
SCSI II PCMCIA Adapter	$129

IBM

Item	Price
20MB Flash Card Type 1	$935
30MB Flash Card Type 2	$1345
40MB Flash Card Type 2	$1720

PCMCIA HARD DRIVES

Item	Price
170MB Integral	$339
260MB Integral	$415
340MB Integral	$495

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486DX/SX 25 To Pentium 63MHz (W/Socket)	$139
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486DX/SX-33MHz (X3) 486-100MHz	$179
486DX/SX-25MHz (X3) 486-75MHz	$139
Pentium 75MHz to Pentium 125MHz	$350
Pentium 90MHz to Pentium 150MHz	$429
Pentium 100MHz to Pentium 166MHz	$589

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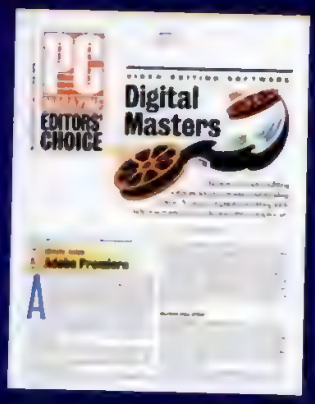

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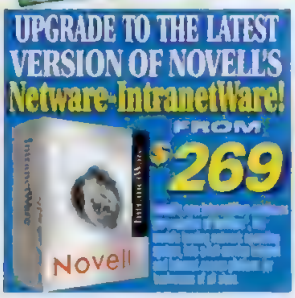

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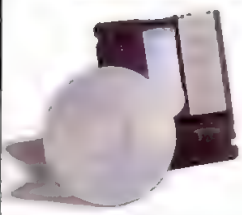

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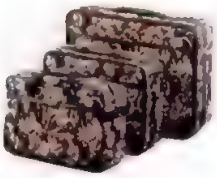

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256x4 Page Zip	-	9.25	9.00	8.95	-
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256x4 SOJ	-	12.00	11.00	-	-
256x16 SOJ	-	30.00	29.00	-	-
256x16 SOJ Edo	-	30.00		-	-
256x16 Video Zip	-	49.00	39.00	-	-

INTEL Math Chips

80287-XL	49.00
80387-DX (Does All)	48.00
80487 SX (Does All)	163.00
Intel SX (Does All)	49.00
Intel SL Mobil	30.00

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Cyrix 330X $39 Cyrix 400X $79

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Out performs intel overdrive Pentium 83

SIMM MODULES (Add $5.00 for SIPP)

	40NS	50NS	60NS	70NS	80NS	100NS
256 x 9	-	-	-	6.00	5.00	5.00
1Meg x 9 (3 chip)	-	-	16.00	13.00	13.00	-
1Meg x 9 (9 chip)	-	-	22.00	19.00	14.00	14.00
4Meg x 9	-	-	41.00	39.00	39.00	-
16Meg x 9 (9 chip)	-	-	179.00	169.00	169.00	

72 PIN SIMMS (FPM, EDO)

	60NS	70NS	80NS
256 x 36 1 mg	19.00	19.00	19.00
512 x 36 2 mg	26.00	34.00	34.00
1 meg x 36 4 mg	44.00	38.00	38.00
2 x 36 8 mg	74.00	69.00	69.00
4 x 36 16 mg	124.00	119.00	119.00
8 x 36 32 mg	249.00	244.00	244.00
16 x 36 64 mg	699.00	499.00	499.00
1 x 32 4 mg	34.00	29.00	29.00
2 x 32 8 mg	54.00	49.00	49.00
4 x 32 16 mg	109.00	104.00	104.00
8 x 32 32 mg	199.00	199.00	199.00
16 x 32 64 mg	500.00	499.00	499.00
1 x 32 4 mg EDO	36.00	29.00	29.00
2 x 32 8 mg EDO	54.00	49.00	49.00
4 x 32 16 mg EDO	109.00	104.00	104.00
8 x 32 32 mg EDO	199.00	199.00	199.00

DIMMS (168 pin)

APPLE		
1 x 64	8Meg	59.00
2 x 64	16Meg	111.00
4 x 64	32Meg	225.00
8 x 64	64Meg	449.00
16x64	128Meg	1995.00
DELL, OPTIPLEX, GXPRO 200		
3.3V ECC EDO	8Meg	109.00
3.3V ECC EDO	16Meg	209.00
3.3V ECC EDO	32Meg	329.00
3.3V ECC EDO	64Meg	709.00
DELL & GATEWAY		
3.3V SDRAM	8Meg	109.00
3.3V SDRAM	16Meg	209.00
3.3V SDRAM	32 Meg	449.00

ECC SIMMS

Pentium Pro 72 Pin (install in pairs) SIMMS

16Meg	159.00	64Meg	2349.00
32Meg	319.00	128Meg	4629.00

AST MEMORY

Advantage 610, 612, 616	4Meg 8Meg 16Meg 32Meg 64Meg	39/79/124/248/499
Advantage Adventure 4000	4Meg 16Meg	39/124
Advantage Adventure 6000	4Meg/8Meg 16Meg 32Meg 64Meg	39/79/174/248/499
Advantage Adventure 8000	4Meg 8Meg 16Meg 32Meg	34/69/124/229
Advantage Pro 486 SX33 SX25	4Meg 8Meg 16Meg 32Meg	34/69/124/229
Bravo LC	4Meg 8Meg 16Meg 32Meg	34/66/124/229
Bravo LC 5100 5133 5166 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/69/144/249
Bravo MS	4Meg 8Meg 16Meg 32Meg	34/69/124/229
Bravo MS 5100 133 166 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/69/144/249
Bravo MS-T 6150 (pairs)	4Meg 8Meg 16Meg 32Meg	34/69/124/229
Manhattan G v pairs	8Meg 16Meg 32Meg	69/129/239
Premmia 4/33 4/50 MTE 433 (pairs)	4Meg/8Meg 16Meg 32Meg	39/69/129/239
Premmia 4/66D SE 4/33 4/66 (pairs)	4Meg 8Meg 16Meg 32Meg	39/69/120/220
Premmia LX P/60 MX 4/66 P75	4Meg 8Meg 16Meg 32Meg	34/59/119/219

All Other Models Available

NEC MEMORY

Ready 9010 1010 1020 9010 9022 (pairs)	4Meg 8Meg 16Meg 32Meg	29/59/...739
Ready 9510 9520 9522 9530 9532 (pairs)	4Meg 8Meg 16Meg 32Meg	39/69/...739
Ready 7022 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/69/129/249
Image P60 P90 D P100E (pairs)	4Meg 8Meg 16Meg 32Meg	39/69/129/249

We Carry All NEC Memory

HEWELETT PACKERD MEMORY

Netserver 4/66LC 5/133LC pairs	4Meg 8Meg 16Meg 32Meg	49/79/129/249
Netserver LE 486SX33 486DX266	4Meg 8Meg 16Meg 32Meg	49/79/129/249
Netserver LH Plus 5/133 5/166 (EDO ECC)	16Meg 32Meg 64Meg 128Meg	Call
Netserver 4/33LM 5/100LM pairs	4Meg 8Meg 16Meg 32Meg	49/79/139/249
Netserver 5/75LS 5/133 LS4 (pairs)	4Meg 8Meg 16Meg 32Meg	49/79/139/249
Pavilion 5010 7170 pairs	4Meg 8Meg 16Meg 32Meg	49/79/129/249
Vectra 500 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	49/79/119/289
Vectra VA 6/180 6/200 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	49/79/139/289
Vectra VE2 5/75 5/133 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	49/79/139/289
Vectra XA 6/180 6/200 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	49/79/139/289
Vectra XM Series	4Meg 8Meg 16Meg 32Meg	49/79/139/289

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IBM PS/1, PS/2 MEMORY MODULES

Aptiva 300 500 Series	4Meg 8Meg 16Meg 32Meg	34/59/119/219
Aptiva 700 Series (pairs)	4Meg 8Meg 16Meg 32Meg	34/59/119/219
Aptiva A Series (pairs)	4Meg 8Meg 16Meg 32Meg	34/59/119/219
Aptiva C Series (EDO pairs)	4Meg 8Meg 16Meg 32Meg	29/59/144/249
Aptiva M Series	4Meg 8Meg 16Meg 32Meg	34/59/119/219
PC 330 Models 6571-6576	4Meg 8Meg 16Meg 32Meg	34/59/119/219
PC 330 Model 6577 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/59/144/249
PC 340 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/59/144/249
PC 350 Models 6581-6586	4Meg 8Meg 16Meg 32Meg	34/59/119/219
PC 350 Model 6586 (pairs)	4Meg 8Meg 16Meg 32Meg	34/59/119/219
PC 350 Model 6587 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/59/144/219
PC 360	4Meg 8Meg 16Meg 32Meg	44/69/129/229
PC 730 Models 6875-6876 (pairs)	4Meg/8Meg/16Meg/32Meg	49/69/139/259
PC 730 Model 6877 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/59/144/219
PC 750 Models 6885-6886 (pairs)	4Meg/8Meg/16Meg/32Meg	49/69/139/259
PC 750 Model 6887 EDO pairs	4Meg 8Meg 16Meg 32Meg	39/59/144/219
PC Server 310 (pairs)	4Meg 8Meg 16Meg 32Meg	49/69/135/259
PC Server 500 (ECC pairs)	4Meg 8Meg 16Meg 32Meg	59/79/119/249
P/S 1 30 Pin Simms	1Meg 4Meg	12/39
P/S 1 72 Pin Simms	4Meg/8Meg/16Meg 32Meg	49/79/139/249
P/S 2 55SX 65SX	4Meg	49
P/S 2 53 53LS 56 57	4Meg 8Meg	49/79
P/S 2 95XP ECC pairs	4Meg 8Meg	49/79
P/S 2 Server 95 195 295 (ECC pairs	4Meg/8Meg/16Meg 32Meg	59/79/119/249

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IBM NOTEBOOK & LAPTOP MEMORY

Thinkpad 340 345 355 360 C CE	4Meg 8Meg 16Meg	49/109/189
Thinkpad 360C CS CD E ED	4Meg 16Meg	79/209
Thinkpad 365X 365XD	8Meg 16Meg 32Meg	109/189/539
Thinkpad 500 510CS	4Meg 8Meg 16Meg	79/109/219
Thinkpad 560	8Meg 16Meg 32Meg	109/189/539
Thinkpad 700 720 750 CL57SX	4Meg 8Meg 16Meg 32Meg	49/109/189/379
Thinkpad 701 701C	4Meg 8Meg 16Meg 32Meg	69/109/169/749
Thinkpad 730T TE	4Meg 8Meg 16Meg	49/109/189
Thinkpad 755C CE CD CS	4Meg 8Meg 16Meg 32Meg	49/109/179/339
Thinkpad 760C CD L LD	4Meg 8Meg 16Meg 32Meg	99/179/339
Thinkpad 760E ED EL ELD	8Meg 16Meg 32Meg	109/184/539

COMPAQ MEMORY MODULES

Deskpro 486/25, 33L 50L	2Meg/8Meg/32Meg	39/99/249
Deskpro 3/25I 33L 4/25S 66f	2Meg/4Meg/8Meg	39/59/99
Deskpro 386 486 M Series	2Meg/4Meg/8Meg	39/60/99
Deskpro M Series Expansion Board	OK (no memory)	119.00
Deskpro 450 4100 575 590 5100 5133	4Meg/8Meg/16Meg/32Meg	34/59/119/219
Deskpro 575 5120 5133 5150 5180 (EDO pairs)	4Meg/8Meg/16Meg/32Meg	34/59/139/249
Deskpro 2000 4000 6000 Series EDO pairs	4Meg 8Meg 16Meg 32Meg	34/59/139/249
Deskpro 5/60M 5/66M, XL560 (quads)	2Meg 4Meg 8Meg 16Meg 32Meg	39/49/69/129/239
Deskpro XL (pairs)	4Meg/8Meg/16Meg/32Meg	39/49/69/139/239
Deskpro XL 6150 6200 (ECC pairs)	8Meg/16Meg/32Meg/64Meg 128Meg	Call
Presario 510 520 524 660 720 724 880	4Meg 8Meg 16Meg 32Meg	34/59/109/219
Presario 920 924 954 974 978 982	4Meg 8Meg 16Meg 32Meg	34/59/109/219
Presario 833 850 860 986	4Meg 8Meg 16Meg 32Meg	39/64/119/239
Presario 5520 7110 7152	4Meg/8Meg/16Meg/32Meg	34/59/109/219
Presario 7170 7180 9530 9546 9548 9564 (pairs)	4Meg/8Meg/16Meg/32Meg	34/59/109/219
Presario 9232 9234 9240 9250 9642 9880 (pairs)	4Meg/8Meg/16Meg/32Meg	34/59/109/219
Prosignia 500/5/60 2000 R 4000 R (quads)	4Meg 8Meg 16Meg 32Meg	39/64/119/239
Prolinea 1500 1500R pairs	4Meg 8Meg 16Meg 32Meg	39/64/119/239
Proliant 4500 4500R (quads)	4Meg/8Meg 16Meg 32Meg 64Meg	39/64/119/239/599
Proliant 5000 5000R pairs	32Meg/64Meg 128Meg/256Meg	Call
Prolinea 4/25S 4/33 4/66	2Meg 4Meg 8Meg	39 49/69
Prolinea enhanced M7	4Meg/8Meg 16Meg/32Meg	49/69/129/229
Prolinea 575 590 5100 5120 5133 (pairs)	4Meg 8Meg 16Meg 32Meg	39/69/119/239
Prolinea 5100 5120 5133 5150 5166 (EDO pairs)	4Meg 8Meg 16Meg 32Meg	39/69/139/259
Prolinea 5/75E 100E 120E 575MX (pairs)	4Meg 8Meg 16Meg 32Meg	39/69/119/239
Prolinea 590MX 5120MX pairs	4Meg 8Meg 16Meg 32Meg	39/69/119/239
Prolinea 6150E 6180E pairs	8Meg 16Meg 32Meg	69/119/239
Prosignia 300 5/75 5/90 5/120 5/150 (pairs)	4Meg 8Meg 16Meg 32Meg	39/69/119/259
Prosignia 500 5/90 5/120 5/150 pairs	4Meg 8Meg 16Meg 32Meg	39/69/119/259

COMPAQ NOTEBOOK & LAPTOP MEMORY

Armada 1120 T	8Meg/16Meg/32Meg/64Meg	119/199/Call/Call
Armada 4100 4110 4120 4130	8Meg/16Meg/32Meg Kit	Call
Concerto 4/25 433	4Meg 8Meg 16Meg	79/99/169
Contura 4/25 C CX	4Meg 8Meg 16Meg	79/99/169
Contura 400C 400CX 410C 410CX	4Meg 8Meg 16Meg	79/99/169
Contura 420C 420CX 430C 430CX	4Meg/8Meg 16Meg 24Meg	49/79/169/239
Contura Aero 4/25 4/33	4Meg 8Meg 16Meg	69/99/169
LTE 5000 5100 5200 5300	8Meg/16Meg 32Meg/64 Meg Kit	99/149/266/513
LTE Elite 4140C CX 4/75CX	4Meg 8Meg 16Meg 24Meg	49/89/179/249

LASER PRINTER MEMORY UPGRADES

AMOUNT UPGRADED	ON BD	256k	1	2	3	3.5	4	5	6	8	16	32
Brother 630 631 641 645		-	69	89			-	-	-	-	-	-
Canon LBP 430	-	-	39	-	-	-	49	-	-	-	-	-
Canon LBP 860 1260	-	-	-	39	-	-	99	-	-	94	144	399
Canon LBP4 4Lite 4plus	-	-	129	179	-	-	-	-	-	-	-	-
Epson 6000 Action Laser	-	-	-	129	-	-	229	-	-	-	-	-
Epson Action Laser 1100 1000	-	-	69	70	-	-	99	-	-	169	259	-
Epson Action Laser			74		173			272		-	-	-
Epson 8000 1800 4000 4100 4200	-	-	89	-	173	-	-	272	-	-	-	-
Epson 1000 1500 5000 5200	-	-	-	69	-	-	179	-	-	-	-	-
HP 2 2D	-	-	-	69	-	-	99	-	-	-	-	-
HP 3 3D 3P 3P Plus	-	-	-	69	-	-	69	-	-	-	-	-
HP 4 4M 4SI 4SIMX				49			59			99		
HP 4P 4PLUS 4MPlus 1600 1600CM			19	29			49			89		
HP 4L		-	34									-
HP 3SI		-	38				69			99		
HP 5L			49	74	-		89			199		
HP 5P 5MP 4V 4MV			19	39			49			89	124	
HP Design Jet 600 650 200				39			49			89	139	239
HP Design Jet 330 330C 350 350C	-	34	-	-	-	-	-	-	-	-	-	-
HP Desigjet 1200C 1200C/P	-		-	39			49			89		-
HP Paintjet XL300		54					69		-	144	299	
IBM Laser 4019 4019E	-					139	-					
IBM Laser 4029 4037							89					
IBM Laser 4039 4079	-		-	69	-	-	69	-	-	169	-	-
Konica LP 3110 3115	-		119	189	239							
Lexmark Medley 4C 4x 4SX			Call	Call	Call							
Lexmark Optra L LX R RX	-		-	-			59			94	139	259
Lexmark Valuewriter 300 600	-	-	29	39	-	-	89	-	-	-	-	-
Lexmark Winwriter 200 400 600	-	-	29	39	-	-	69	-	-	-	-	-
NEC 90 290	-	-	-	89	-	-	-	-	-	-	-	-
NEC 95 97	-	-	-	79	-	-	-	-	-	-	-	-
Oki 400	-	-	-	79	-	-	-	-	-	-	-	-
Oki 400E 400EX 410E 410EX	-	-	69	109	109	-	109	-	-	-	-	-
Oki [illegible]			29	39			79			119	169	
Oki 830 840			-	89								
Oki 2350 2450			Call	Call								
Packard Bell PS 9500	-	-	-	139	-	-	227	-	-	-	-	-
Packard Bell 9815	-	-	-	139	-	-	229	-	-	-	-	-
Panasonic 4420/4450	-	-	-	99	-	-	169	-	-	-	-	-
Panasonic 4410/4430	-	-	-	89	-	-	189	-	-	-	-	-
Panasonic 4450	-	-	89	-	-	-	-	-	-	-	-	-
Panasonic 4400/5400	-	-	99	99	-	-	109	-	-	-	-	-
Panasonic 4440 5410 6500	-	-	79	99	-	-	139	-	-	-	-	-
Sharp 9400 9460 9600 9700E	-	-	89	99	-	-	149	-	-	-	-	-
Sharp 9500 E H 9700 H	-	-	79	-	-	-	209	-	-	-	-	-
TI XL/PS17/PS35	-	-	49	-	-	-	-	-	-	-	-	-
TI Microlaser Pro E Powerpro Pro 600	-	-	89	129	-	-	169	-	-	329	-	-
TI Microwriter	-	-	79	119	-	-	-	-	-	-	-	-

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NEC Versa E, V — $119.00
NEC Versa S — $119.00
Toshiba 610 and 400 — Call
Toshiba 1900, 1910, 1950, 1960 — $119.00
Toshiba 2400, 4700, 4800, 4900 — $119.00
Toshiba 2100 Series — $121.00

TOSHIBA LAPTOP MEMORY

MODEL	AMT UPGRADED	MANU PART #	PRICE
Tecra 500/P550	8Meg/16Meg/32Meg 48Meg 72Meg		119/229/499/Call/Call
Tecra 700 (SDRAM)	8Meg/16Meg/32Meg		119/239/479
Tecra 710, 720	8Meg/16Meg/32Meg/64Meg/128Meg		119/239/429/Call/Call
T2000SXE 2200SX T1800 1850 C	8Meg	PC-PA2000U	94.00
T2100 2105 2150 2155 2110 2115	4Meg/8Meg/16Meg/24 Meg		69/99/169/229
T4500 C T4600 T4700 T1900 C T1910 T1950 (3.3v)	4Meg	PC-PA2012U	69.00
T4500 C T4600 T4700 T1900 C T1910 T1950 (3.3v)	8Meg	PC-PA2013U	79.00
T4500 C T4600 T4700 T1900 C T1910 T1950 (3.3v)	16Meg/32Meg	PC-PA2014L	159/279
T3400CT T2400 T3600	4Meg/8Meg 16Meg/24Meg	PC-PA2018U	69/119/179/Call
T100 105 110 115	8Meg 16Meg 32Meg		119/199/319
T400 405 410 415 420 425	8Meg 16Meg 32Meg		119/199/319
T400CS 400CDT T100 105 Edo	8Meg 16Meg 32Meg		119/199/319
T600 610 C1 Edo	8Meg 16Meg 32Meg		119/189/319

NOTEBOOK, LAPTOP MEMORY

MODEL	AMT UPGRADED	MANU PART #	PRICE
ACERNote 730C 735C 760C 760CX 760CX	2Meg 4Meg 8Meg		49/69/99
ACERNote 763 765 782 784 786	4Meg 8Meg 16Meg		59/79/159
ACERNote Light 350 352 355	4Meg 8Meg 16Meg		69/99/169
ACERNote Light 356 358 359 361 (pairs)	4Meg 8Meg 16Meg		69/99/169
ACERNote Pro 950 954 955 957 958 (pairs)	4Meg 8Meg 16Meg		79/109/189
Ambra N Series	4Meg/8Meg/12Meg/16 Meg		69/109/139/189
Ambra SN Series	4Meg/16 Meg		79/179
Ambra N 75 N 100	4Meg 8/16		49/89/169
AST Ascentia P30, P50	8Meg/16Meg 32Meg		89/169/309
AST Ascentia J10, J30, J50	4Meg/8Meg/32Meg/64Meg Kit		69/109/Call/Call
AST Ascentia 900N 800N 810 910	8Meg 16Meg		99/189
AST Ascentia 950	8Meg 16Meg		99/189
AST Bravo & Explorer	4Meg 16Meg	501239-001, -002	79/219
AST Notebook Prem Exec 386SX/20/25/25L	4Meg	500814-002	69.00
AST Power Exec 3/25C 425EL 425SL	4Meg 16Meg	501168-001 -002	79/189
AST Power Exec 4/33SL	4Meg 16Meg	501318-001 002	79/189
AT&T Globalyst 130 200 250	4Meg 8Meg 16Meg		69/99/149
Austin 2x4 DX2 SX2 SX Series	4Meg 16Meg		79/219
Austin Vista	4Meg/8Meg/16Meg/20Meg		Call
Canon Innova Book 150 175	4Meg 16Meg		69/189
Canon Innova Book 200LS	4Meg/8Meg/16Meg 24Meg		69/99/219/349
Canon Innova Book 10SCD 360 475	8Meg 16Meg		89/189
Canon Innova 486 10	4Meg 16Meg		79/219
CTX EZ Book 5/60 Pent Series	4Meg 8Meg 16Meg		Call
DEC HiNote Ultra HiNote	4Meg 8Meg 16Meg		69/109/189
DEC HiNote VP	8Meg/16Meg 32Meg		89/189/289
Dell Latitude LM (pairs)	4Meg/8Meg 16Meg		69/99/189
Dell Latitude 433 C CX	4Meg 16Meg		79/199
Dell Latitude LMP pairs	4Meg 8Meg 16Meg		79/119/189
Dell Latitude LM	4Meg 8Meg 16Meg		79/119/189
Dell Latitude XP XPi	4 Meg 8Meg 16 Meg		79/119/189
Epson ActionNote 650 650c 660c 660cx	4Meg 8Meg 16Meg		69/109/189
Epson ActionNote 730 700c 700cx	4Meg 16Meg		79/189
Epson ActionNote 880 860c 890	4Meg/8Meg 16Meg/20Meg		59/89/159/189
Epson ActionNote 4LC/25 4LC/33 4SLC2-50 4000	8Meg		79.00
Everex Tempo LX LX20 Carrier	2Meg	PCA 00083-0001	89.00
Fujitsu Monte Carlo	8Meg/16Meg/32Meg		79/169/299
Gateway 2000 Colorbook 4/33	4Meg 16Meg		69/179
Gateway 2000 Nomad 425 DXL/SXL	4Meg 16Meg		159/759
Gateway 2000 486 Handbook or Liberty	4Meg 16Meg		59/169
Gateway 2000 Solo Series	4Meg/8Meg 16Meg		79/109/189
Gateway 2100 Solo Series	8Meg 16Meg 32Meg		Call/Call/Call
Hitachi C Series	8Meg/16Meg/32Meg		99/169/369
Hitachi M Series	8Meg/16Meg 32Meg		129/249/619
HP Omnibook 300 400 425	2Meg 4Meg		83/129
HP Omnibook 530 600	4Meg/8Meg 12Meg		69/99/149
HP Omnibook 4000	4Meg/8Meg 16Meg		69/99/189
HP Omnibook 5000	8Meg/16Meg 32Meg		99/169/319
Leading Edge Avnu 2000	4Meg 16Meg		69/179
Lexmark SX10	4Meg 8Meg		79/119
Magnavox Metalis	4Meg	286, 386SX	119.00
Micron Transport Pentium	8Meg 16Meg Kit		119/219
Midwest Micro Elite or Soundbook	4Meg 8Meg 16Meg		79/119/189
Midwest Micro Elite or Soundbook Plus or Stella II MP	4Meg 8Meg 16Meg		79/119/189
Midwest Micro Elite or Soundbook CD	4Meg 8Meg 16Meg		79/119/189
NCR Safari 3180 3181	4Meg 8Meg		79/119
NEC Ultralite Versa E V MP	4 Meg/8Meg 16Meg 20Meg	OP4104	64/99/199/299
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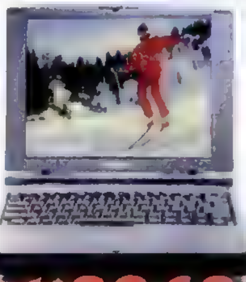

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Creative Digital Research CDR HYCD for Unix -For Unix workstations -Creates hybrid CDs for PC/Mac/Unix (CDRHYUNIX)	$1299

4 - CHOOSE YOUR SCSI CONTROLLER

16Bit	ISA	PIO	Adaptec	(A1505CDKIT)	$50
16Bit	ISA	Bus Master	Advansys	(ABP5140)	$95
32Bit	PCI	Bus Master	Advansys	(ABP940)	$125
32Bit	PCI	PIO	Adaptec	(A2920KIT)	$149
32Bit	PCI	Bus Master	Adaptec	(A2930KIT)	$179

5 - CHOOSE YOUR BLANK MEDIA

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50 Pack (CDR74-50)	$359
100 Pack (CDR74-100)	$699
300 Pack CDR Labels, template software, and applicator	$59

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Converts any 3 1/2" hard drive into a removable drive. Great for transportability, data interchange, or security needs. Extremely high quality construction. Metal cartridge and frame, cooling fan. Unit has SCSI ID select on the cartridge. Qty discounts available.

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IDE	**$79**	**$39**	**$49**
SCSI	**$85**	**$40**	**$54**
WIDE SCSI	**$129**	**$64**	**$75**

Weather resistant case to store and transport cartridge $35

• OPTICALS •

All Optical Drive prices below include **1 FREE cartridge.**

230MB	Fujitsu IDE	$339
230MB	Smart Storage Solutions SCSI	$339
640MB	Smart Storage Solutions SCSI	$539
640MB	Fujitsu (230MB backwards compatible)	$555
650MB	Toray 4xCD and 640MB Optical comb.	$499
	Call about Rebate (expires 12-31-96)	
2.6Gig	Smart Storage Solutions	$1649
2.6Gig	Maxoptix	$1699
2.6Gig	Hewlett Packard	$2199
52Gig	Maxoptix (does not include free disks)	$4549

• REMOVABLES •

540MB MCD

Compatible w/ SyQuest 270MB media. SCSI Int/Ext $249/$299

SyQuest

230MB Flyer compatible with EZ135MB disks
External SCSI or parallel with 1 free disk $299

200MB compatible with 44 and 88MB disks
Internal SCSI/External SCSI $339/$399

1.5Gig 1 free disk Internal SCSI/External SCSI $399/$499

100MB Zip

External SCSI with 1 disk/Ext Parallel with 1 disk $189/$189

1 GB Jaz

Internal SCSI with 1 disk/Ext SCSI with 1 disk $379/$469

• CD RECORDERS •

These COMPLETE KITS include drive, controller, software, and 1 recordable CD disk. Smart Storage Solutions kit includes 5 FREE recordable CD disks!

Smart Storage Solutions	2X Write 4X Read	$499
HP	2X Write 4X Read	$569
Smart & Friendly	2X Write 4X Read	$529
Teac	4X Write 4X Read	$829
Smart Storage Solutions	4X Write 4X Read	$889
Yamaha	4X Write 4X Read	$819

• CD ROM DRIVES •

Brand	Spin	Model	Speed	Int	Ext
SCSI					
NEC	4X	CDR222	200ms	$99	$189
Plextor	6X	PX63CS	145ms	$269	$359
Philips	8X	PC80S	195ms	$225	$325
NEC	8X	CDR1410	145ms	$219	$309
Plextor	8X	PX83CS	115ms	$339	$429
Pioneer	10X	DRU10XSCSI	140ms	$225	$315
Plextor	12X	PX12TS	105ms	$319	$409
Plextor	12X	PX12CS	105ms	$349	$439
ATAPI IDE				**Int**	**Int kit**
NEC	8X	CDR1400	140ms	$110	$140
Mitsumi	8X	CRMCFX800	150ms	$110	$140
Acer	10X	AC910A	150ms	$125	$155
Pioneer	10X	DRA10X	140ms	$135	$165
Lite On	12X	LTN126A	155ms	$129	$159
Acer	12X	AC612A	125ms	$149	$179
CyberDrive	12X	CYBER12X	150ms	$115	$145
Mitsumi	12X	CRMCFX12X	150ms	$175	$205
IDE CD ROM CHANGER					
NEC	4X	CDR4X4	4 Disk	250ms	$99
SCSI CD ROM CHANGERS					
Nakamichi	8X	MJ48S	4 Disk	150ms	$399
Pioneer	4.4X	DRM-624X	6 Disk	190ms	$359

• TAPE DRIVES •

QIC MINICARTRIDGE **(SAVE $10 with hard drive purchase)**

Includes DOS/Win backup software and 1 free tape.

800MB	Seagate	TST800R	$119
3.2Gig	Seagate	TST3200RFT	$215

PRINTER PORT MINICARTRIDGE

Includes DOS/Win backup software.

800MB	Seagate	TST800RP	$160
3.2Gig	Seagate	TST3200RP	$259

IDE or SCSI TRAVAN **(SAVE $10 with hard drive purchase)**

Includes DOS/Win backup software and 1 free tape.

4-8GB	Seagate	TST8000(A)	$379

SCSI 4mm DAT

2GB	Hewlett Packard	C1534AI	$609
2-4GB	Seagate	C4324RP	$679
2-4GB	Hewlett Packard	C1536AI	$699
4-8GB	Sony	SDT5000AI	$809
4-8GB	Seagate	C4326NP (DDS2)	$859
4-8GB	Hewlett Packard	C1533AI	$929
4-8GB	**Sony**	**SDT7000**	**$909**

TURBO SPEED 46MB/sec uncompressed or 90MB/sec with onboard compression!

24-48GB	HP	External 6 tape loader C1553AX	$2299
32-64GB	Sony	TSL7000 8 tape autoloader	$2199
48-96GB	Seagate	C4586NP 12 tape autoloader	$2399

SCSI 8mm DAT

3.5-7GB	ExaByte	EXB8205XL	$1269
7-14GB	ExaByte	EXB8505XL	$1889
7-14GB	ExaByte	EXB8700LT	$1029
20-40GB	ExaByte	EXB8900	$5499
70-140GB	ExaByte	EXB10H 10 tape autoloader	$5439
SCSI DLT	**20-40GB**	**Quantum DLT4000**	**$4699**

BACKUP SOFTWARE **(SAVE $10 with hard drive purchase)**

NovaStor's NovaBack CD contains software for DOS, Win 3.1, Win 95, OS/2, Warp, and Macintosh $79

NovaStor's NovaDisk CD contains software to backup to disk drives and removables $79

Seagate Arcada for Windows NT (call for netware version) workstation/single server/enterprise $239/499/869

TAPEDISK, allows DAT drive to be used as hard drive under DOS/Win 3.1, Win 95 $189

Call for the best prices in the industry on backup tapes!

• IDE HARD DRIVES •

IDE	Speed	RPM	Brand	Model	Wty	Price
540MB	14ms	3600	Seagate	ST3541A	3	$139
631MB	14ms	3600	Seagate	ST3630A	3	$145
850MB	10ms	4500	Western Digital	WDAC2850	3	$165
850MB	14ms	3600	Seagate	ST3851A	3	$155
1200MB	10ms	5400	Fujitsu	M1636T	3	$195
1275MB	12ms	4500	Seagate	ST31276A	3	$189
1280MB	11ms	4500	Quantum	TM31280A	3	$195
1281MB	11ms	5200	Western Digital	WDAC21200	3	$199
1330MB	12ms	4480	Maxtor	M71336A	3	$195
1623MB	14ms	3600	Seagate	ST31621A	3	$212
1624MB	10ms	5200	Western Digital	WDAC21600	3	$219
1670MB	11ms	4480	Maxtor	M71670A	3	$215
1700MB	10ms	5400	Fujitsu	M1623T	3	$215
1700MB	12ms	4500	Seagate	ST31720A	3	$215
1700MB	11ms	4500	Quantum	SR31700A	3	$219
2004MB	11ms	4480	Maxtor	M72004A	3	$255
2100MB	11ms	5200	Western Digital	WDAC22100	3	$265
2100MB	9ms	5400	Fujitsu	M1624T	3	$249
2132MB	12.5ms	4500	Seagate	ST32132A	3	$270
2168MB	10.5ms	4500	Quantum	TM32160A	3	$259
2500MB	9ms	5400	Fujitsu	M1638T	3	$259
2550MB	15ms	3600	Quantum	BF2500A	3	$242
2559MB	11ms	5200	Western Digital	WDAC32500	3	$275
2560MB	11ms	5400	Seagate	ST5250A	3	$292
2700MB	12ms	4480	Maxtor	M72700A	3	$305
3166MB	12ms	5200	Western Digital	WDAC33100	3	$325
3254MB	10.5ms	4500	Quantum	TM33200A	3	$325
3500MB	12ms	4480	Maxtor	M83500A	3	$419
3840MB	10.5ms	4500	Quantum	TM33840A	3	$389

• SCSI HARD DRIVES •

SCSI	Speed	RPM	Brand	Model	Wty	Int	Ext
1050MB	9ms	5400	Seagate	ST31055N	3	$349	$409
1280MB	12ms	4500	Quantum	TM31280S	3	$279	$339
2050MB	8.5ms	7200	Micropolis	MC4221	5	$545	$599
2050MB	8.5ms	7200	Micropolis	MC4221AV	5	$600	$660
2110MB	10.5ms	4500	Quantum	TM32110S	3	$375	$435
2147MB	9ms	5400	Micropolis	MC4421	5	$369	$429
2147MB	9ms	5400	Micropolis	MC4421AV	5	$459	$519
2147MB	8ms	7200	Seagate	ST32550N	5	$729	$789
2150MB	9ms	5400	Seagate	ST32155N	5	$479	$539
2150MB	8ms	7200	Seagate	ST32171N	5	$739	$799
3254MB	10.5ms	4500	Quantum	TM33200S	3	$449	$509
4294MB	8ms	7200	Seagate	ST15230N	5	$885	$945
4294MB	8ms	7200	Micropolis	MC3243	5	$829	$889
4294MB	8ms	7200	Micropolis	MC3243AV	5	$885	$945
4350MB	8ms	7200	Seagate	ST34371N	5	$1145	$1205
4400MB	8ms	7200	Fujitsu	M2954S	5	$819	$879
4550MB	8ms	7200	Quantum	XP34550S	5	$999	$1059
4550MB	7.9ms	7200	Micropolis	MC4345	5	$999	$1059
9080MB	11ms	5400	Seagate	ST410800N	5	$1779	$1879
9091MB	8.5ms	7200	Micropolis	MC3391	5	$1799	$1859
9100MB	12ms	5400	Micropolis	MC1991	5	$1599	$1699
9100MB	12ms	5400	Micropolis	MC1991AV	5	$1699	$1799
9100MB	9ms	7200	Seagate	ST19171N	5	$2085	$2145
9100MB	8ms	7200	Quantum	XP3900S	5	$1599	$1659
WIDE SCSI							
1050MB	9ms	5400	Seagate	ST31055W	5	$379	$509
2050MB	8.5ms	7200	Micropolis	MC4221W	5	$629	$759
2050MB	8.5ms	7200	Micropolis	MC4221WAV	5	$689	$819
2150MB	9ms	5400	Seagate	ST32155W	5	$529	$659
2150MB	8ms	7200	Seagate	ST32171W	5	$779	$909
4294MB	8ms	7200	Micropolis	MC3243W	5	$929	$1059
4294MB	8ms	7200	Micropolis	MC3243WD	5	$899	$1029
4294MB	8ms	7200	Micropolis	MC3243WAV	5	$1039	$1169
4350MB	8ms	7200	Seagate	ST34371W	5	$1189	$1379
4550MB	8ms	7200	Quantum	XP34550W	5	$999	$1059
9091MB	8.5ms	7200	Micropolis	MC3391W	5	$1999	$2129
9100MB	11ms	5400	Seagate	ST410800W	5	$2029	$2219
9100MB	9ms	7200	Seagate	ST19171W	5	$2149	$2279
9100MB	12ms	5400	Micropolis	MC1991W	5	$1699	$1889
9100MB	12ms	5400	Micropolis	MC1991WAV	5	$1839	$2029
9100MB	8ms	7200	Quantum	XP3900W	5	$1599	$1659

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1MB Video 171017-001 $49
Presario 972, 974, 978, 982, 992, 5526, 5528, 5536, 9536, 9546, 9548, 9564, ProLinea 4100 466, 5120MX, 575MX, 590MX, 5100, 5133, 5120, 5100, 575, 590, ProLinea 450, 5100s, 5120s, 575s, 6150s, 6180s, Deskpro 4100, 450, 466, 575MX, 590MX, 5100, 5120, 5133, 575, 590
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[illegible]
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[illegible]
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[illegible] MB Exp. Brd H314758 $69
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[illegible] 16MB [illegible]
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Concerto 4/25, 4/33 Models
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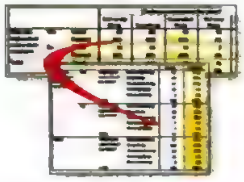

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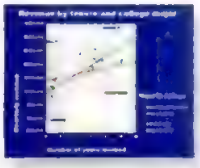

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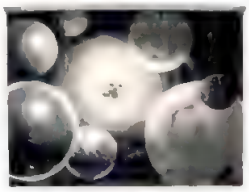

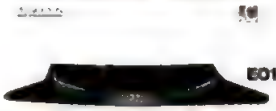

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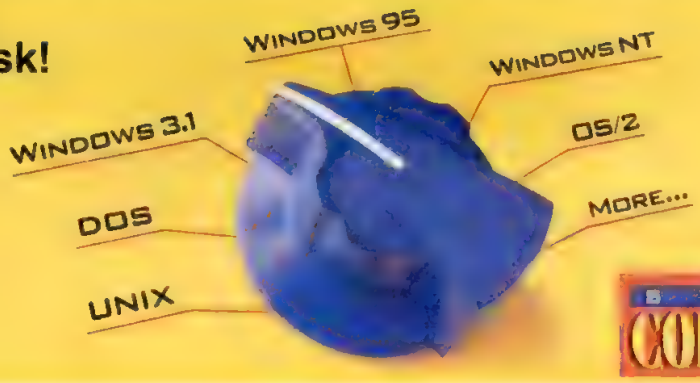

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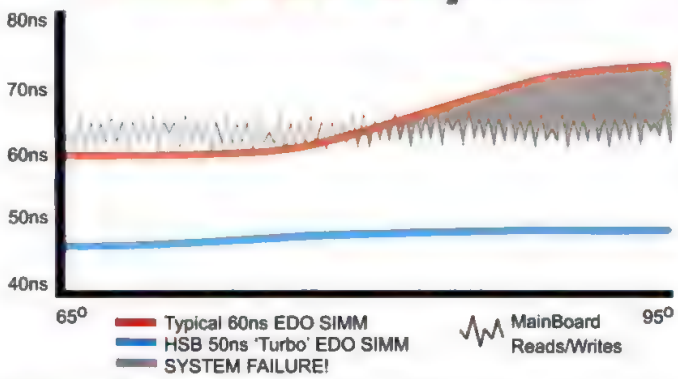

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Dot Stripe Pitch	.25mm ap	0.26mm ap	.25mm ap
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[illegible]	24.82kHz	80.65kHz	24.82kHz
[illegible]	Yes	No	Yes
[illegible]	Yes	No	Yes

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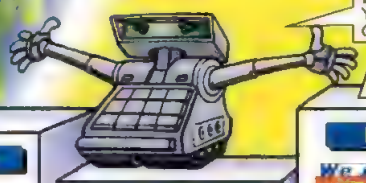

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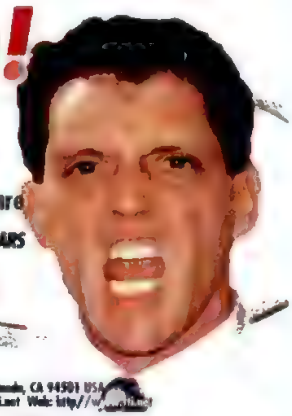

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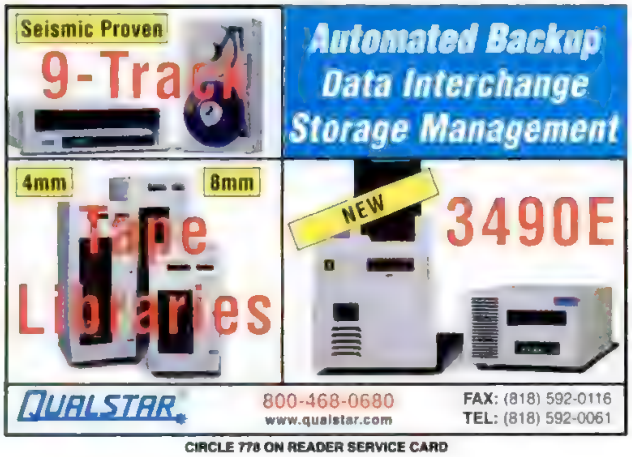

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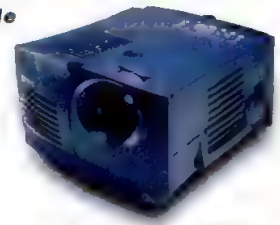

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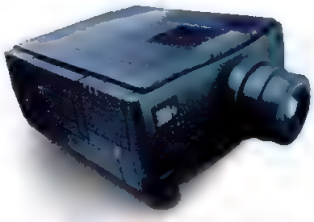

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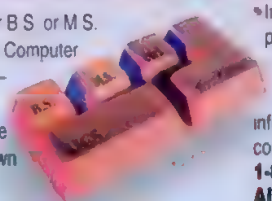

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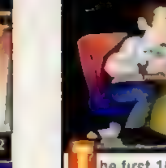

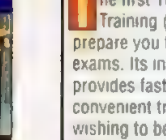

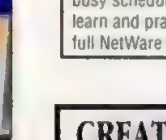

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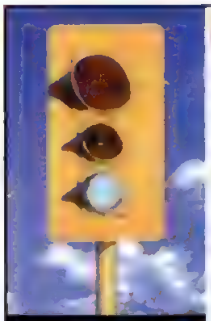

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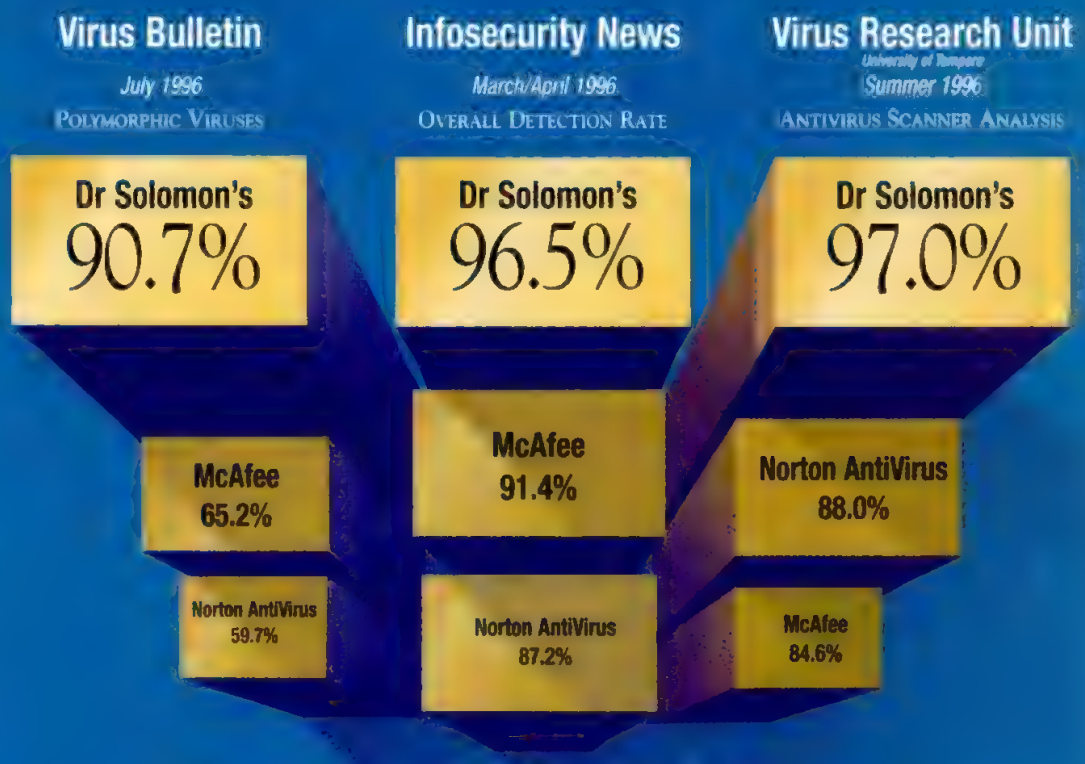

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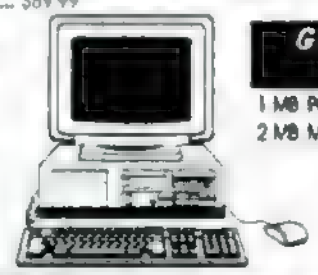

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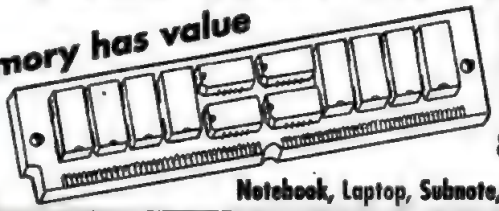

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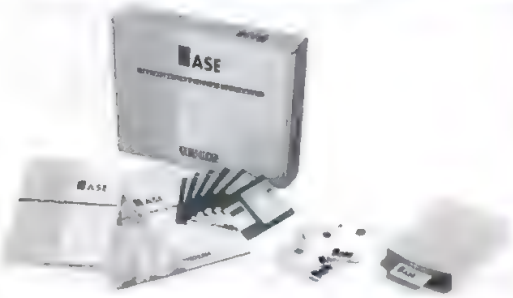

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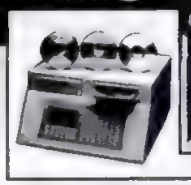

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CIRCLE 266 ON READER SERVICE CARD

At Home

A SPECIAL REPORT ON PRODUCTS FOR THE PERSONAL SIDE OF COMPUTING

MAKING YOUR MONEY MAKE MONEY

By Kathy Yakal

If your New Year's resolutions include a promise to be more responsible about your finances, or if you'd simply like to squeeze a bit more horsepower out of the finance software you already use, you'll be pleased to see this year's crop of personal finance programs. There's a new face, a major face-lift for an old favorite, more electronic banking options, and better, more focused connections to the Internet. Throw in a healthy dose of tweaks here and there and you have a group of software packages that can help make financial management easier and less time-consuming.

We looked at four personal finance programs this time around: MECA Software's Managing Your Money ($79.95), Microsoft Money 97 ($35), Intuit's Quicken Deluxe for Windows ($60), and a newcomer to this category, Surado Solutions' Smart Home Manager ($59.95). A fifth program, Simply Money, was not included because it was being retooled by its new publisher, CD Titles ($15, 800-345-6665; *www.cdtitles.com*), as we went to press. Finally, Parsons Technology's Money Counts is no longer being marketed to individual consumers.

At the core, all of these products continue to perform the same tasks that Quicken and Managing Your Money did when they pioneered this software category over a decade ago. They

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ILLUSTRATION BY MICHAEL KLEIN

Editors' Choice

• Quicken Deluxe for Windows 6.0

PC MAGAZINE EDITORS' CHOICE

Last year, the contest for Editors' Choice in this category was tight. Though Intuit's Quicken Deluxe and Microsoft Money had strengths in different areas, their respective levels of excellence were perhaps closer than they had ever been. This year, however, Quicken Deluxe alone takes top honors. Intuit has completely revamped Quicken's interface, resulting in a smoother, cleaner, and less confusing look than previous versions sported.

This remodeling is all the more impressive when you consider that the product now provides even more features and functions than last year's version. New Internet links, more banks supported, easier setup, a debt-reduction feature, a tax-deduction finder, and a host of other improvements make Quicken the undisputed leader in the personal finance market.

are repositories for your financial account information and for your monetary transactions. They help you create budgets and balance your bank accounts. They also help manage your investments, build reports and graphs, and ease the pain of assembling your tax-related transactions. The better packages also provide such features as electronic banking and Internet connectivity. All the while, they provide a certain amount of advice. We looked at each product with these elements in mind and marched the packages through the most common features used by money-conscious consumers.

Managing Your Money has not been updated since last year's roundup, so we revisited the current version for this article. A new version is in the works and should be available by the time you read this.

At first glance, Microsoft Money 97 doesn't look all that different from last year's version. The elegant, exceptionally usable interface introduced in 1995 remains much the same as it was then. Scratch the surface, though, and you'll find a number of small changes sprinkled throughout. More banks now participate in Money 97's online banking services. New Wizards, including a Paycheck Wizard and even a Converter Wizard for Quicken, make daily chores easier.

Last year's Editors' Choice, Quicken Deluxe for Windows, offered more personal finance processing power and guidance than had ever before been available to consumers—all this behind an interface that could barely contain all the features and functions. This year's version sports an interface that has been altered so dramatically as to be unrecognizable to previous users. But the result is impressive, and since this is combined with an even better feature set, Quicken is a pleasure to look at and a joy to use.

For the first time in recent years, a brand-new competitor has entered this software category. Smart Home Manager found itself pitted against formidable competition in this story, although the product is more than a personal finance manager: The package also provides e-mail and database functions as well as other features for home users.

Using these reviews as a guide, we're sure that you'll find a product to help organize your finances and make the most of your money.

MECA Software, L.L.C.

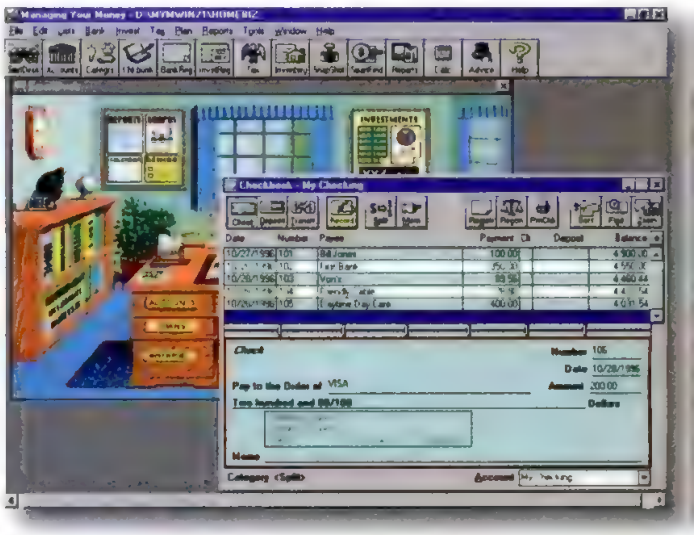
Managing Your Money

ALL REVIEWS BY
KATHY YAKAL

While its competitors have been streamlined, expanded, and otherwise improved since last year, Managing Your Money (MYM) has been treading water. By the time you read this, a new version of the package should be available (3.0), but the one we tested here—Version 2.10—was virtually unchanged since last year's roundup. The product offers strong tax and financial planning features but lags behind Microsoft Money 97 and Quicken Deluxe in terms of interface, capabilities, and usability.

MYM offers two methods for navigating its various features: You can take the traditional route, using the program's standard toolbar and drop-down menus, or you can opt for the graphical route, clicking on objects in the program's SmartDesk, an on-screen representation of an office. Using SmartDesk, you can click on any labeled picture (such as the accounts drawer) to move into the appropriate program area.

If you're generally familiar with personal finance software, you shouldn't have any trouble getting started with MYM. But the package does not offer any help for new users, so greenhorns will have to work a bit harder to get up to speed. You



WHETHER YOU USE Managing Your Money's SmartDesk or the traditional toolbar and menus, data entry operates just the same.

Our Contributors: KATHY YAKAL, a freelance author specializing in financial software, is a frequent contributor to *PC Magazine*. MICHAEL E. RYAN was the associate editor in charge of this story.

can import files from previous versions of MYM or from other programs that export data in Quicken's .QIF file format. If you're starting from scratch, you'll need to enter account information along with basic information about checking, savings, credit card, cash, investment, and other asset or liability accounts you want to establish. MYM lets you categorize each financial transaction, so you'll want to check the product's basic categories in order to modify them to suit your needs. You'll also need to enter information about your creditors.

MYM makes it easy enough to track basic account-related transactions. You can move money around to reflect such transactions as checks, deposits, transfers, and ATM withdrawal. The transaction-processing screen, which displays the appropriate form and register on-screen simultaneously, is within easy reach of multiple icons, pull-down lists, and menus that help you perform such tasks as establishing recurring transactions, splitting a transaction to classify it by more than one category, and reconciling your checkbook.

Apart from the basics, however, MYM quickly falls behind Quicken. MYM's reporting features were acceptable a year or two ago, but they are somewhat dated today. Still, if you don't need the latest and greatest, you can generate a perfectly acceptable group of financial reports to see where you've been and where you're going. Also, MYM's budgeting features are unremarkable but adequate. You can set up budgets based on data from a previous period and apply across-the-board or varied figures for future tracking.

MYM has always excelled in tax and financial planning, and it was the first personal finance program to offer a debt reduction tool. This useful feature lets you pull in your debt information and experiment with different pay-off plans, so you can find the optimal scheme. You can export your financial data into most popular tax packages, and (better yet) you can make some tentative tax projections throughout the year using MYM's tax planning tools.

For investment tracking, MYM lets you set up multiple portfolios, process common transactions, and download quotes via CompuServe. MYM does not yet offer any online banking features or Internet links.

Managing Your Money is no longer the powerful force it once was, but you can still count on it to provide basic transaction processing, reporting, and planning tools.

REPORT CARD

Managing Your Money

	Power	Ease
Checkbook management	B	A
Budgeting	C	B
Tax and financial planning	A	A
Portfolio management	B	A
Electronic connections	C	B

Managing Your Money, Version 2.10. List price: $79.95. MECA Software, L.L.C.; Trumbull, CT; 203-452-2600; www.mymnet.com. *Circle 468 on reader service card.*

REPORT CARDS

Reading the Report Cards

We graded each of these four packages on both power and ease of use in five categories. We used the following grades: A—excellent, B—above average, C—average, D—below average, E—failing.

Products that fared well for **checkbook management** not only assist users in setting up accounts and tracking income and expenses; they also aid account reconciliation and provide a variety of reporting options.

High marks for **budgeting** indicate a program that lets users create budgets of varying levels of detail, sort income and expenses by category, set spending and earnings objectives, and produce detailed reports.

These products should also provide solid **tax and financial planning** tools. Products that did well here help users figure out tax liability throughout the year and provide tools for calculating loan payments.

For **portfolio management,** high scores indicate a product that can track a variety of investments, differing transaction types, and investing goals.

Products scoring well for **electronic connections** allow users to pay bills online (whether through a bank or a third party), provide users with 24-hour access to up-to-the-minute account information, and offer useful Internet links.

Microsoft Corp.

Microsoft Money 97

Last year, Microsoft Money emerged as a force to be reckoned with. Its sleek Windows 95 interface, exceptional usability, and financial management features presented Intuit's Quicken with a formidable competitor. This year's version, Microsoft Money 97 5.0, retains the look and feel of its predecessor while adding many functional improvements, particularly in the area of online banking. Money 97 still lacks some of the general financial management tools that Quicken offers, but this latest version is clearly a first-tier home banking front end and personal money manager.

Getting started with Money 97 is easy, even if you have to import data from another finance package (Money 97 can import data in .QIF or ASCII format). Quicken users have an even easier route: Money 97's new Conversion Wizard for Quicken walks you through the steps required to grab an existing Quicken data file and drop its contents into Money 97.

When the time comes to enter data, Money 97 lets you assign every financial action a set of predefined but customizable categories, such as groceries and insurance. Categories can be designated as tax-related and even assigned to the correct IRS form or schedule, simplifying data preparation at tax time.

Transaction entry in Money 97 has been modified slightly for the sake of convenience, but it still lacks the cohesiveness and ease that has always been Quicken's trademark. Money 97's Account Wizard simplifies the setup of accounts to house your transactions. These range from asset to cash to retirement.

The data entry screen for all accounts contains a checkbook-like register at the top and a set of forms below. Each form contains tabs representing the types of transactions that can be completed.

Bills, deposits, and fund transfers can be automated in Money's Financial Calendar. A wizard makes this a no-brainer, but a generous number of payment interval options give you plenty of flexibility. This

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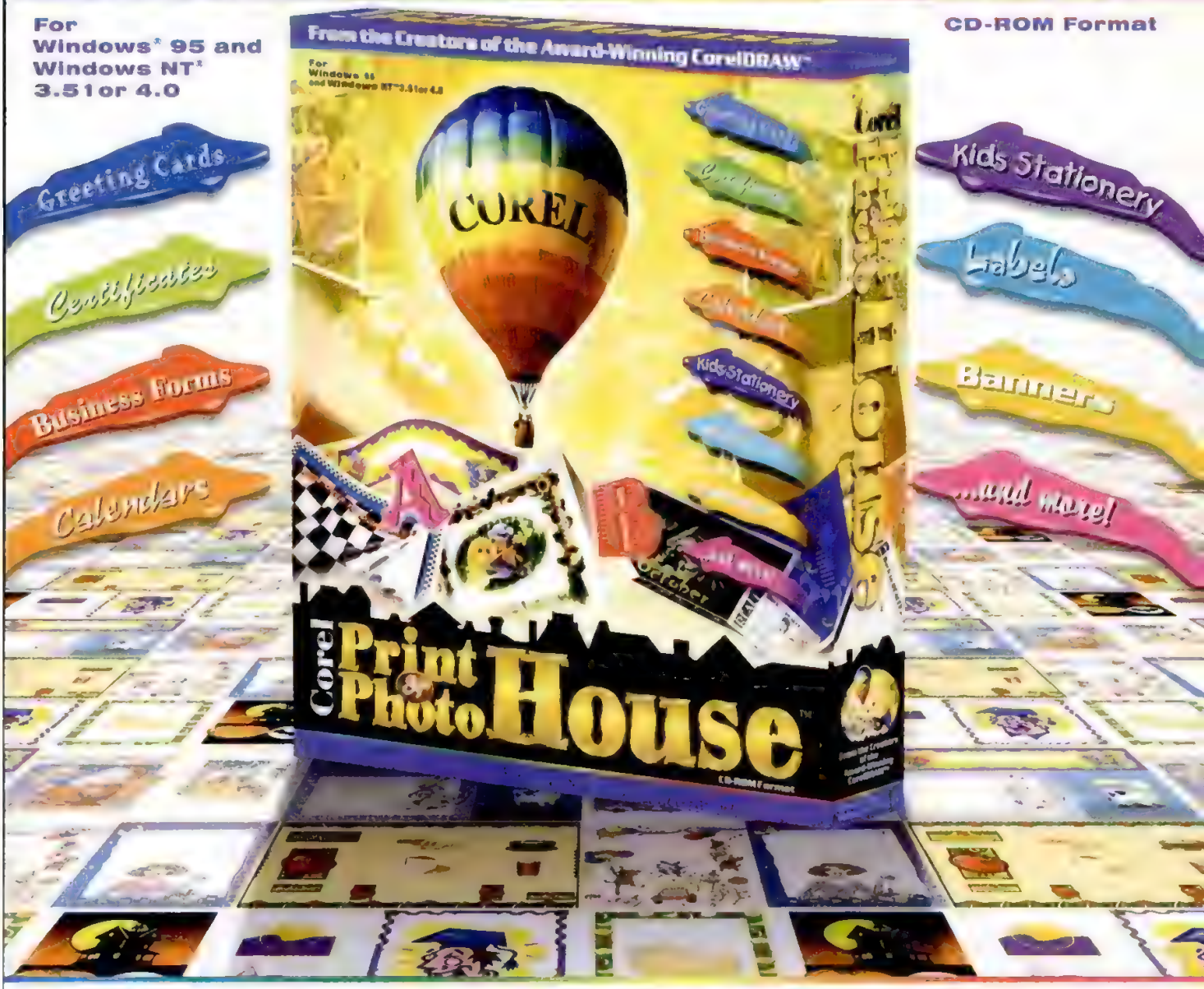

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Going Online with Your Finances

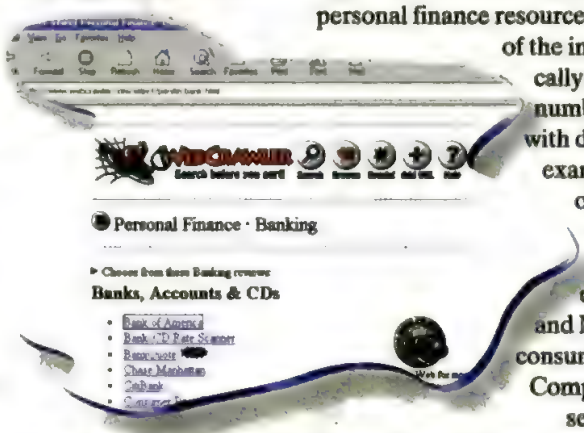
Although it's a good and useful idea to link personal finance software with online financial resources, the software packages simply can't keep up with the ever-growing list of money services available on the Internet. They're everywhere. These resources include simple calculators, question-and-answer guides, financial magazines and newsletters, and informational sites provided by organizations such as the Better Business Bureau and the Internal Revenue Service. Some of these sites are sponsored by organizations that would like to have your business, but others exist solely for your edification.

To see for yourself just how much information is available, try pointing your browser at one of the many search engines that track personal finance sites of interest, such as WebCrawler (*www.webcrawler.com/select/persfin.new.html*). This site indexes a set of pointers to Web locations that cover topics from banking to insurance to taxes.

In addition, several banks now offer online banking services and bill payment via the Internet. To find out if your bank has set up camp in cyberspace, you can do a search on WebCrawler or any other search engine to find its home page.

Now that America Online has become such a bargain for high-usage subscribers, you might want to check out AOL's personal finance resources (keyword: *finance*). Though a lot of the information here is geared specifically toward investors, there are a number of tools designed to help out with day-to-day financial affairs. For example, as of this writing, 19 banks offer online banking and bill payment through AOL's home banking services. Two consumer advocacy forums, Bank-Rate Monitor and MoneyWhiz, provide unbiased consumer finance information.

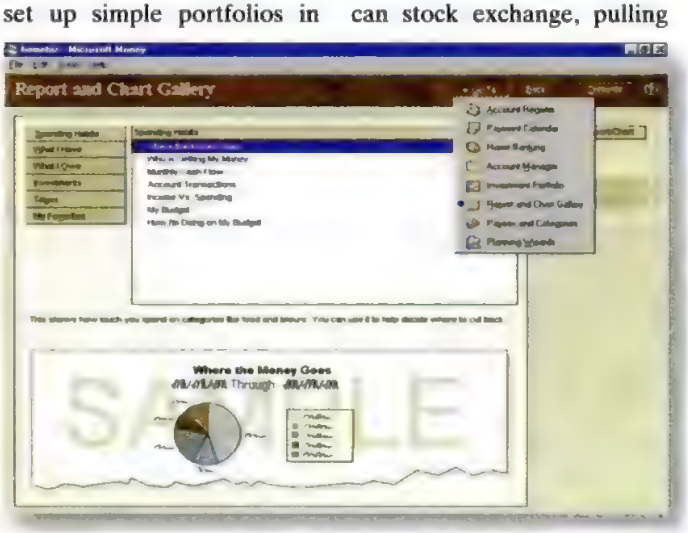
CompuServe also offers a collection of services geared at consumers tracking their finances (GO MON18). Some are free, but many incur an additional fee tacked onto CompuServe's hourly rates. You can find information on saving and borrowing money, learn about tax planning and preparation, and peruse hundreds of money-related newspapers, magazines, and newsletters.—*KY*



WebCrawler and other search engines can help point you toward the Web's myriad personal finance resources.

process would be even simpler if it were better integrated into the account register screens.

If you're not tracking your portfolio elsewhere, you can set up simple portfolios in Money 97 to manage stocks, bonds, and mutual funds. Internet users can grab stock quotes listed on the NASDAQ, New York, or American stock exchange, pulling these in to update their portfolios automatically. You can also use your own Web browser to connect Money 97 with the Money Zone, the product's home base on the Internet.



THE CLEAN NEW LOOK that Microsoft debuted in last year's version of Money is back, and there are even more features this time around.

Money 97's reporting capabilities haven't changed much since last year. You can easily create and customize reports relating to your home and business income and expenses, tax liabilities, and investments. The package's planners have also not been altered. You can use these to compare two real-estate loans, amortize loans, work toward a savings goal, plan for retirement, and estimate interest on an account.

REPORT CARD

Microsoft Money 97

	Power	Ease
Checkbook management	A	A
Budgeting	A	A
Tax and financial planning	C	A
Portfolio management	B	A
Electronic connections	A	A

The lion's share of Money 97's enhancements fall in the home banking arena. The Home Banking Wizard helps you determine what your online banking and bill-paying options are. If your bank is one of the 58 supported by Money 97, you can pay your bills via online links through the program. Otherwise, you can still pay bills using CheckFree or Visa e-Pay.

Money 97's interface certainly rivals Quicken's. The opening screen displays pictures that represent the program's main sections; it also features a chart of the day and a tip of the day. Without exception, Money 97's screens are skillfully de-

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Planning for the Future

It's all well and good to talk about how personal finance software can help manage your money, but what if the money you're trying to manage is minimal? Or what if you're getting a late start on planning for your golden years? We looked at two new products that can help in these areas. Neither was shipping in time for our story, but both should be available by the time you read this.

Retire Ready ($49.95 list; Individual Software, 800-822-3522) is a retirement planner aimed at baby boomers and pre- and post-retirees. Through a combination of analysis and education, Retire Ready helps users put together realistic plans to meet their goals—even if they feel they started too late.

Using the program's Retirement Calculator, you can find out how much money you'll need to accumulate to live the lifestyle you want after you retire. Using charts, graphs, animation, and video, the program gives you information on a variety of topics related to retirement issues, such as investment decisions, health care, and Social Security. Lists of recommended questions to ask service providers, checklists, and summaries are among the tools employed.

Floater helps you decide which bills to put off and which to pay on time.

The other program, **Floater** ($30 list; Floater Corp., 617-769-8451), is a bit different. Instead of planning for retirement, Floater helps you take care of your immediate future by helping you determine which bill you should delay paying for lack of funds.

Using Floater, you first enter data about all of the bills you owe, including such variables as late fees and grace periods. You then rank each bill using an "embarrassment factor" (how likely are you to be personally embarrassed if you skip paying this bill?) and the bill's potential impact on your credit rating. Floater then helps you decide which bills should be paid now and which you might consider delaying until more funds are available, offering multiple possible scenarios.—*KY*

signed and nicely intuitive.

Though it has not made quantum leaps forward as it did last year, Money 97 remains a top-notch personal finance manager with a focus on the future: online banking and the Internet.

Microsoft Money 97 5.0. Street price: $35. Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. *Circle 469 on reader service card.*

Intuit Inc.

Quicken Deluxe for Windows

PC MAGAZINE EDITORS' CHOICE

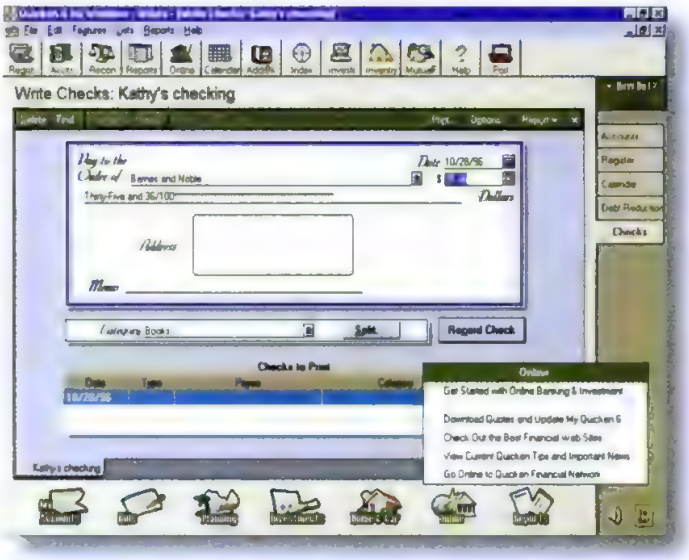
A year ago, we had a tough time deciding which product should wear the personal finance crown, Intuit's Quicken or Microsoft Money. But this year, the decision was easy: Quicken Deluxe for Windows is on top all by itself.

Every bit of Quicken has undergone at least minor functional or structural renovation this year, with the interface being the most obvious. Gone is the overly colorful and sometimes confusing look of Quicken 5, replaced by a tamer, tighter, more dignified appearance. The extra features included in Version 6.0 of Quicken Deluxe for Windows, such as Mutual Fund Finder and Investor Insight, have been blended neatly into the main program.

Getting started with Quicken takes little time or exertion. You can either use the product's EasyStep feature to help you through the process or hit the summary tab to cut right to the chase. Quicken imports ASCII and .QIF files for those users switching over from another package.

Transactions are entered much as they've always been: You can enter checks and deposits on a blank check form or in the register itself, designating each to be printed, transmitted online, or simply recorded. Transfers and ATM withdrawals can also be recorded. You can split transactions and assign them to more than one category and use Quicken's tools that facilitate account reconciliation and budgeting.

In terms of helping the user plan for the future while managing the present, Quicken clearly outshines its competitors. For example, the new Debt Reduction Planner helps



WHEREVER YOU ARE in Quicken, it's easy to go somewhere else **thanks to** new navigational aids and a less confusing interface.

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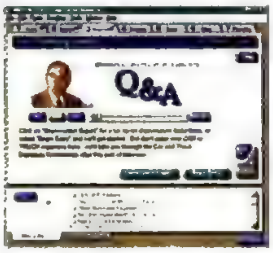

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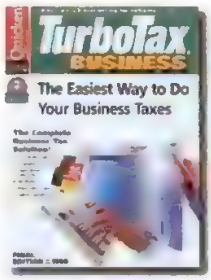

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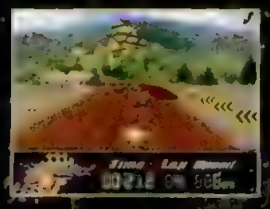

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you develop a workable plan for reducing your debt as quickly as possible. It suggests an order for paying off your credit cards, based on their outstanding amounts and interest rates, and helps you find ways to divert some of your existing resources into your debt reduction efforts.

Other planning tools help you plan for and minimize future tax obligations, obtain your credit report, and slice and dice your financial data to produce highly customizable reports and graphs.

For investors, Quicken Deluxe provides a wealth of features. You can document your investment activity in multiple portfolios, look at both price histories and current prices, and gauge the success of your selections. You can also download free stock quotes from the Internet to update your portfolio. Quicken's Investor Insight provides access to online investment news and research, and it lets you set up a Watch List of securities for regular price downloads (at an additional cost of $9.95 per month). And you can research mutual funds and update their prices using the Mutual Fund Finder.

Using your Web browser (Quicken Deluxe includes a free copy of Netscape Navigator), you can connect to the Quicken Financial Network (QFN) and Quicken Live—an Intuit Web site that downloads Quicken news and announcements, maintenance fixes, and other news. A list of useful Web-based personal finance sites, updated monthly by Excite, is also available through the program.

Although Quicken Deluxe now supports 38 banks for online banking, the number is far smaller than Microsoft Money

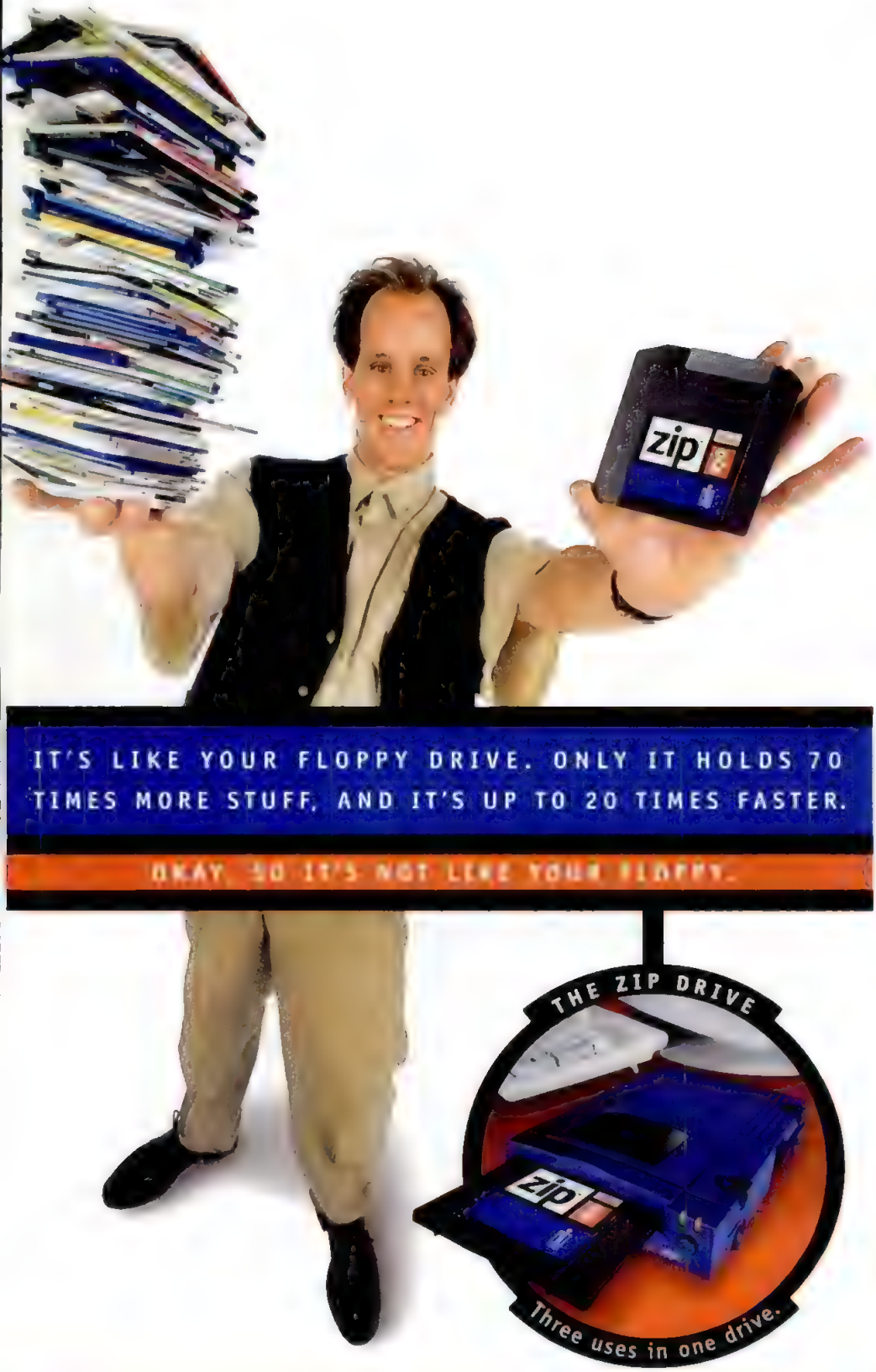
SUMMARY OF FEATURES

Personal Finance Software

■ YES ▨ NO

Products listed in alphabetical order	Managing Your Money 2.10	Microsoft Money 97 5.0	Quicken Deluxe for Windows 6.0 (PC MAGAZINE EDITOR'S CHOICE)	Smart Home Manager 1.5
Price	$79.95 (list)	$30.00 (street)	$60.00 (street)	$59.95 (list)
General Features				
32-bit version available	▨	■	■	▨
Automatic on-screen help	■	■	■	▨
Includes links to Web sites	▨	■	■	▨
Ships with Web browser	▨	▨	■	▨
Online tutorial	■	■	■	▨
Offers financial advice based on user input	■	▨	■	▨
Format for imported data	.QIF	.QIF	.QIF	N/A
Banking Functions				
Number of account types available	5	11	8	11
Memorizes recurring transactions	■	■	■	■
Schedules future transactions	■	■	■	■
Number of banks for which electronic banking is available	N/A	58	38	N/A
Reconciles account	■	■	■	■
Links to electronic credit card statements	▨	■	■	▨
Bill Payment				
Provides bill-payment reminders	■	■	■	■
Bill-paying services	CheckFree, MYM-Pay	Pay Online	CheckFree, Intuit Financial Services	None
Budgeting Features				
Splits transactions among categories	■	■	■	■
Forecasts future cash flow	■	▨	■	▨
Automatically sets up budget account based on prior-year input	▨	■	■	■
Reports				
Number of predefined reports	25	26	28	26
User can customize report formats in content/appearance	■ ▨	■ ■	■ ■	■ ▨
Creates instant reports from transactions	■	▨	■	▨
User can view supporting data from report view	■	■	■	▨
Graphs and Charts				
Number of predefined charts	7	15	5	6
User can customize chart formats in content/appearance	■ ▨	■ ■	■ ■	■ ▨
User can view supporting data from chart view	■	■	■	▨
User can view multiple charts simultaneously	▨	▨	■	▨
Supports 3-D charts and graphs	▨	▨	■	■
Portfolio				
Allows multiple views of portfolio	■	■	■	▨
User can customize views	▨	■	■	▨
Supports multiple portfolios	■	■	■	▨
Tracks investments beyond stocks, bonds, and mutual funds	■	■	■	■
Number of predefined transaction types	11	13	18	6
Links to online quote service	■	■	■	▨
Financial Planning				
Calculates loan amortization tables	■	■	■	■
Number of financial-planning calculators	13	5	5	4
Offers debt management based on user input	■	▨	■	▨
Loan Tracking				
User can link loan account to checking account	■	■	■	■
Credits loan when user makes payment from checking account	■	■	■	■
Automatically splits payments between principal and interest	■	■	■	■
Tax Planning				
Estimates tax liability	■	▨	■	▨
Links categories to specific forms and schedules	■	■	■	▨
User can export data to major tax programs	■	■	■	▨
User can view and print preliminary forms and schedules	■	▨	▨	▨
Helps find tax deductions	▨	▨	■	▨

N/A—Not applicable: The product does not have this feature.



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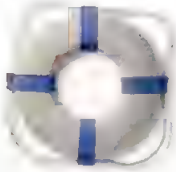

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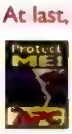
iomega.

CIRCLE 244 ON READER SERVICE CARD

"They thought my new Multipath™ Back-UPS® Office™ was just a big surge suppressor – then the lights went out."

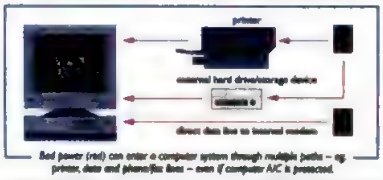
At last, a safe place to plug everything: Multipath Back-UPS Office for workstations, PC's and peripherals



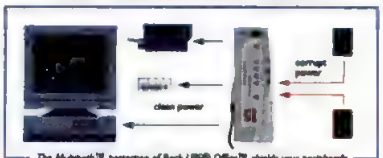
Facing the darkness is hard, but inevitable: You have a better chance of winning the lottery than of escaping power problems: They're the single largest cause of computer data loss and hardware damage.

Back-UPS Office provides reliable power for your entire system. Instantaneous battery backup ensures uninterrupted operation of your CPU, monitor and an external storage device. Full-time surge suppression and site-wiring fault protection spreads a true Multipath™ safety net under any remaining integrated peripherals, like modems, printers, faxes and phone systems. Back-UPS Office also provides convenient BlockSafe™ outlet spacing to handle all size plugs – even large block transformers.

Multipath™ Means Total Power Protection



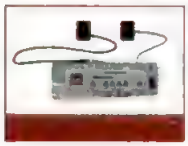
Bad power (red) can enter a computer system through multiple paths – eg. printer, data and phone/fax lines – even if computer A/C is protected.



The Multipath™ protection of Back-UPS® Office™ shields your peripherals and guards your computer from bad power on every path, providing clean, safe power (green), to your entire system.

Unique Multipath protection keeps your PC and data safe

Plugging a phone line into your computer doubles your vulnerability to power problems; add any peripheral, and it triples. Even if your AC power-line is shielded, when a surge hits an unprotected peripheral, it can blaze down serial and data lines, and toast your expensive PC.



Back-UPS Office's compact design installs easily on desktop, floor or mounts to wall.

Multiple peripherals and data lines to and from your system are vital, but dangerous. Without them, you can't do your job. However, if a power sag makes your modem drop the line while you're downloading from the Internet, or locks your keyboard before you've saved work, you lose time, money and spend another late night at the office to meet your deadline.

Back-UPS Office protects your entire system

Until now, protection for your entire system required several devices. But multi-device protection can leave you vulnerable to line noise and unwanted data glitches created by the voltage differential between outlets. Those glitches are prevented with the Back-UPS Office common voltage reference.

Back-UPS Office means true Multipath™ protection, clean, safe power to every peripheral, and instant battery backup to keep your cutting edge system and O/S from crashing. It means protection for less by integrating the security of a surge suppressor with the power of a UPS, guaranteed up to $25,000.

"Back-UPS Office (is) a shoo-in for the small-office/home-office computing market and for general desktop workstations"
-Computer Reseller News

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Data			•
Phone			•
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Spike	•	•	•
Blackouts		•	•
Brownouts		•	•
Overvoltage			•
Battery Backup Protection			
with Pentium 100 w/15" monitor		10	10
Protection For			
PC		•	•
Monitor		•	•
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Protection Against Interruption			
Fax/Modem	•		•
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Speakers	•		•
Protection For			
Internet or Network			•

Traditionally, protecting all your equipment meant buying a surge suppressor and a UPS. Even then, only your AC line was protected. New Back-UPS Office protects all paths to your equipment. Bulletproof Multipath protection

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CIRCLE 162 ON READER SERVICE CARD OR GO TO WWW.PCMAG.COM/ProductLink

97's roster of 58 banks.

Quicken's dramatic interface overhaul makes Quicken a pleasure to work with, but more important, it makes the program itself more understandable and its features more accessible. The new Activity Bar at the screen's bottom divides the program's chores into logical groupings, while a traditional toolbar and menu provide alternative paths.

In short, Quicken Deluxe is simply the best of the bunch.

REPORT CARD

Quicken Deluxe for Windows

	Power	Ease
Checkbook management	A	A
Budgeting	A	A
Tax and financial planning	A	A
Portfolio management	A	A
Electronic connections	A	A

Quicken Deluxe for Windows, Version 6.0. Street price: $60. Intuit Inc., Mountain View, CA; 800-446-8848, 415-944-6000; www.intuit.com. *Circle 470 on reader service card.*

Surado Solutions Inc.

Smart Home Manager

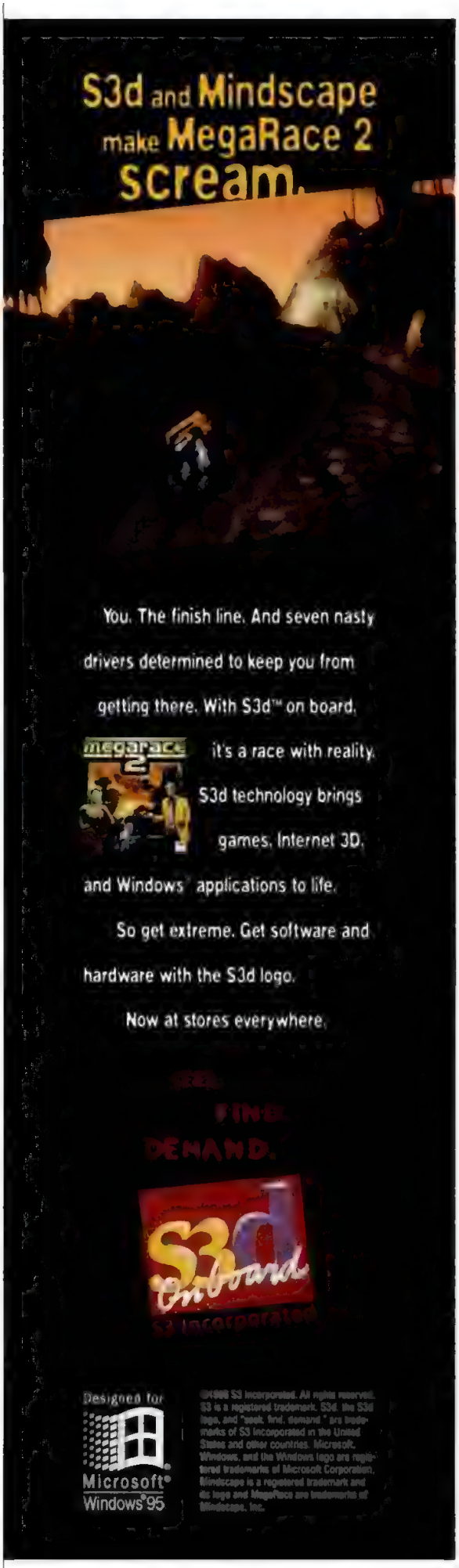
Smart Home Manager, the new kid on the block, does more than just process financial transactions. It also provides basic scheduling and task list management and several mini-databases for tracking household items such as medical records, warranties, and home repairs.

Smart Home Manager's interface takes some getting used to, since it uses some nonstandard structures, commands, and navigational tools, and it just plain looks dated. But overall, the product's usability is fine. Its personal finance tools can't compete with those offered by Quicken, and critical online links are lacking, but it may appeal to users with very simple financial processing needs and a hankering for the program's extras.

Smart Home Manager doesn't import existing data, and there's no automatic setup help for the new user. But you can move pretty easily into the right part of the program by clicking the appropriate icons. You can set up records for all of your bank and credit card accounts here by filling in data entry screens. A skimpy list of modifiable predefined categories is also located here. A tabbed file folder gives you access to a list of subcategories (which, oddly enough, aren't linked to a particular category) and a data entry screen for your payees.

The transaction entry screen does not resemble a check blank or even a real form, but the standard data is requested here. You can use pull-down lists to enter data from existing records. Rather than earmarking categories as tax-deductible, you make that distinction as you enter each transaction. You can use the Payment Scheduler to designate regularly occurring payments and request either a reminder note or an automatic posting of the transaction. Checks can be printed either individually or en masse. There are no online banking or bill-paying options.

Budgeting, bank reconciliation, and reports are handled adequately but not exceptionally. There are two options for creating a budget: using data from a previous period or entering a figure for each month. While you can pull up a reconciliation screen and mark cleared entries, Smart Home Manager makes no effort to help you reconcile any differences. And the predefined re-



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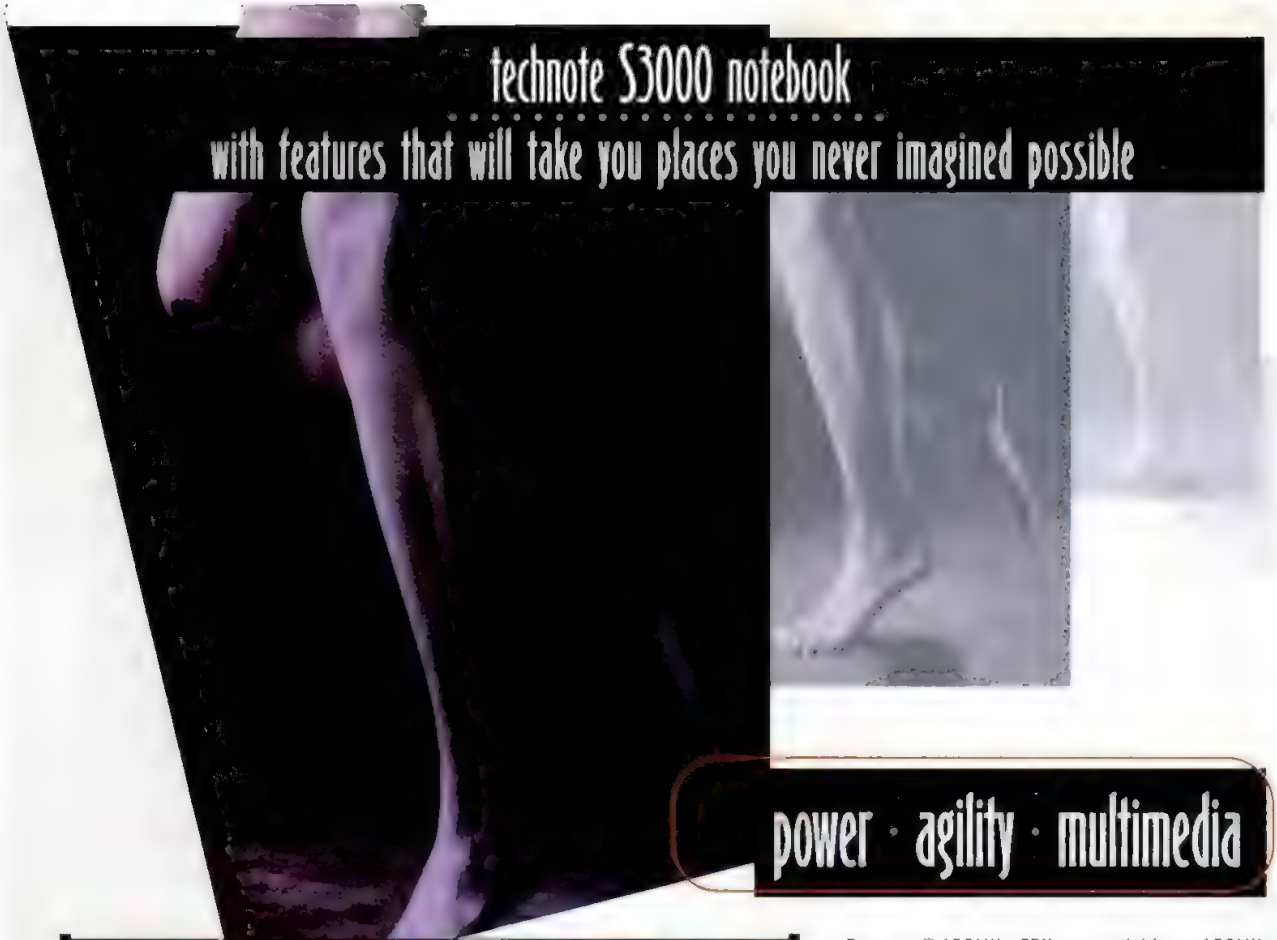

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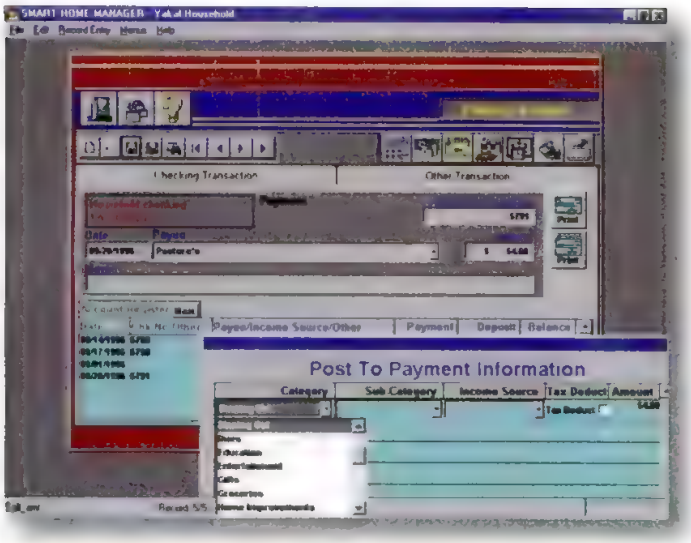


SMART HOME MANAGER lets you categorize transactions, but you must do so by pulling up a second screen.

porting options are acceptable but less thorough than those offered by the competition.

Smart Home Manager provides several screens for loan information entry, including an amortization screen. Financial calculators help you come up with the right financial equations when you're planning for college, retirement, investments, and refinancing.

The product tracks an array of investment information, including brokerage and securities information, transactions, history, and summaries. All stock price updates must be entered manually, since there is no online link.

Smart Home Manager's look and feel would have played well early in the Windows 3.*x* software development cycle, but today it feels clunky. The program's data entry screens do not expand to fill the available space, there are no right-click menus, and some operations require more work than they should.

Still, Smart Home Manager offers some other features that a home user might appreciate, such as a household scheduler, a to-do list, and specialized databases to track information about hobbies, videos, and insurance policies. The product also lets you enter a message to be read by other household members; we're still trying to figure out why this is more convenient than a note on the fridge.

REPORT CARD

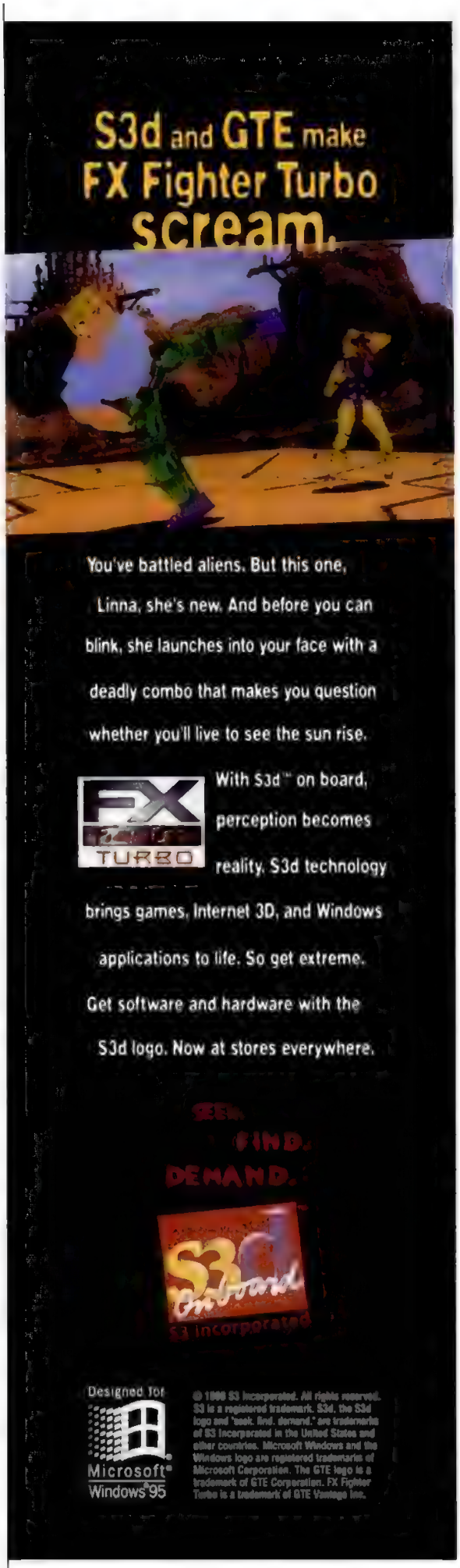
Smart Home Manager

	Power	Ease
Checkbook management	C	C
Budgeting	C	C
Tax and financial planning	C	B
Portfolio management	C	B
Electronic connections	N/A	N/A

N/A—Not applicable: The product does not have this feature.

It's nice to see a fresh face in the personal finance race, and Smart Home Manager's household features may appeal to people whose financial management needs are relatively simple. Overall, though, this is no match for Quicken. □

Smart Home Manager 1.5. List price: $59.95. Surado Solutions Inc., Riverside, CA; 800-478-7236, 909-682-4895; www.surado.com. *Circle 471 on reader service card.*



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MMX Extends the Desktop

This January, Intel debuts the Pentium Processor with MMX Technology, a mainstream chip designed to bolster multimedia and communications. We review 12 200-MHz MMX Pentium systems and test them with our standard benchmark tests plus several MMX-enabled software packages.

ISDN Adapters: Digital Dragsters

ISDN products and services are becoming more affordable—and unlike cable, DSL, or 56-Kbps modems, ISDN is here today. We test and review 18 ISDN adapters, including external units, internal cards, and PC Cards.

CD-R Drives

It's getting cheaper and easier to create your own CD-ROM disks for distributing data. We test 15 drives and help you steer clear of the pitfalls that still abound in this nascent technology.

C++ Development Tools

Some tools still take a traditional approach; others are embracing features of visual RAD tools. We test the latest C++ offerings from Borland, IBM, Microsoft, Powersoft, and Symantec.

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Abort, Retry, Fail?

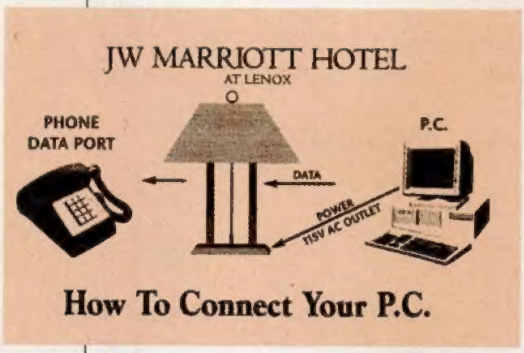
THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

CompuJunk

Hey, when exactly did CompuServe open the junk-mail floodgates? Our mailbox is suddenly full of the most ridiculous "free" offers and get-rich-quick schemes. Here are a few recent message headers:

- Martial Arts in the Privacy of Your Own Home
- Oxygen, Health, and Life!
- Financial Turnaround!
- Make $10,000 a Month at Home!



New at a Marriott hotel in suburban Atlanta: It's the amazing Data Lamp!

RICHARD TENNANT

"Well, this is festive—a miniature intranet amidst a swirl of Java applets."

This powerful new duster doesn't just clean your keys, it blows them away! (Bull Express catalog.)

Internet Oddity du Jour

Just how rich is Microsoft CEO Bill Gates? Surf on over to the Bill Gates Wealth Clock (*www.webho.com/WealthClock*), which divides Gates's holdings by the total U.S. population to determine how much he's worth, per capita. The most recent figure: $71.52.

Infopedia™... the smartest kid in it's class!

Ouch! We say, protect your kid from any encyclopedia that makes mistakes like this! (SoftKey Infopedia ad.)

GROANERS

And then there was the story of the computer repairman who swallowed over half a dozen memory modules, then died. They were the seven deadly SIMMs.

If your entry is used, we'll send you $50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802 or, via e-mail (text items only), to *don_willmott@zd.com*. Winners this issue: Craig DiMonda, Randy Kabrich, Claude Paquin, and Guy Winters.

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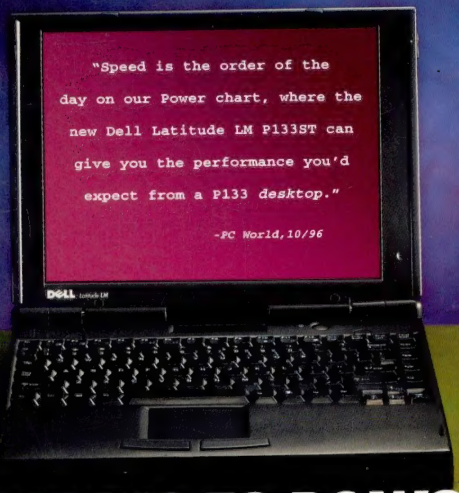

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The Dell Latitude LM P133ST. It looks like a notebook. Yet it performs like a desktop. Sounds like someone's going to have to start a new category! All thanks to *PC World* who started it when they gave us their Best Buy award and said, "the Dell Latitude LM P133ST is a hands-down Best Buy for users looking for a desktop replacement." A bold statement.

They also said things like it's the "fastest notebook we've ever tested." And "Pros: Large, crisp screen; terrifically fast. Cons: none." And to think they didn't even get to its 128-bit graphics accelerator which gives you amazing graphic abilities that your desktop-laden co-workers will envy.

We could go on and on. They certainly did. But we'll let you get to a phone first.

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